

QUATERNARY OSTRACODS FROM THE CONTINENTAL MARGIN
OFF SOUTH-WESTERN AFRICA.
PART II. MINOR TAXA

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(With 87 figs and 4 tables)

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ABSTRACT

One hundred and four species belonging to at least forty-two genera comprise 13 per cent by abundance of the total benthic ostracod fauna from the continental shelf and upper slope between the Kunene River and Cape Agulhas. The remaining 87 per cent of the fauna (comprising 18 species) have previously been described in Part I of this report.

Twenty-six new species are described herein: *Cytherelloidea compuncta*, *Australoecia fulleri*, *Neocaudites lordi*, *Neocaudites osseus*, *Neocaudites punctatus*, *Incongruella venusta*, *Parakrithella simpsoni*, *Cytheropteron whatleyi*, *Cytheropteron trinodosum*, *Cytheropteron cuneatum*, *Cytheropteron frewinae*, *Cytheropteron* aff. *C. frewinae*, *Cytherura siesseri*, *Kangarina sola*, *Kangarina hendeyi*, *Hemicytherura petheri*, *Austroaurila rugosa*, *Mutilus malloryi*, *Urocythereis arcana*, *Coquimba birchi*, *Buntonia namaquaensis*, *Buntonia rogersi*, *Buntonia bremneri*, *Buntonia gibbera*, *Buntonia deweti*, and *Munseyella eggerti*.

Twenty of the species have been previously recorded from the area, and fifty-eight species are left in open nomenclature.

The largest number of species of the minor taxa occurs in water shallower than 300 m, and concentrations of upper and lower depth limits of species occur at 200–300 m (outer continental shelf: mixed layer/Antarctic Intermediate Water boundary) and 500–600 m (upper continental slope: top of AAIW salinity minimum zone). There are important latitudinal range limits (boundaries to faunal assemblages) at 19,5°S (Walvis Ridge abutment), 22,5°S (Walvis Bay), 29,5–31,5°S (Namaqualand shelf), and 34°S (Cape Peninsula).

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INTRODUCTION

In a survey of 269 sea-floor sediment samples from the continental shelf and upper slope off south-western Africa, 192 contained ostracod valves. The eighteen dominant taxa that constitute 87 per cent of the total fauna, were documented in Part I of this report (Dingle 1992), and in the present contribution the taxonomy and distribution of the remaining 13 per cent, represented by 104 species, are described. These species were encountered in 134 samples (Fig. 1).

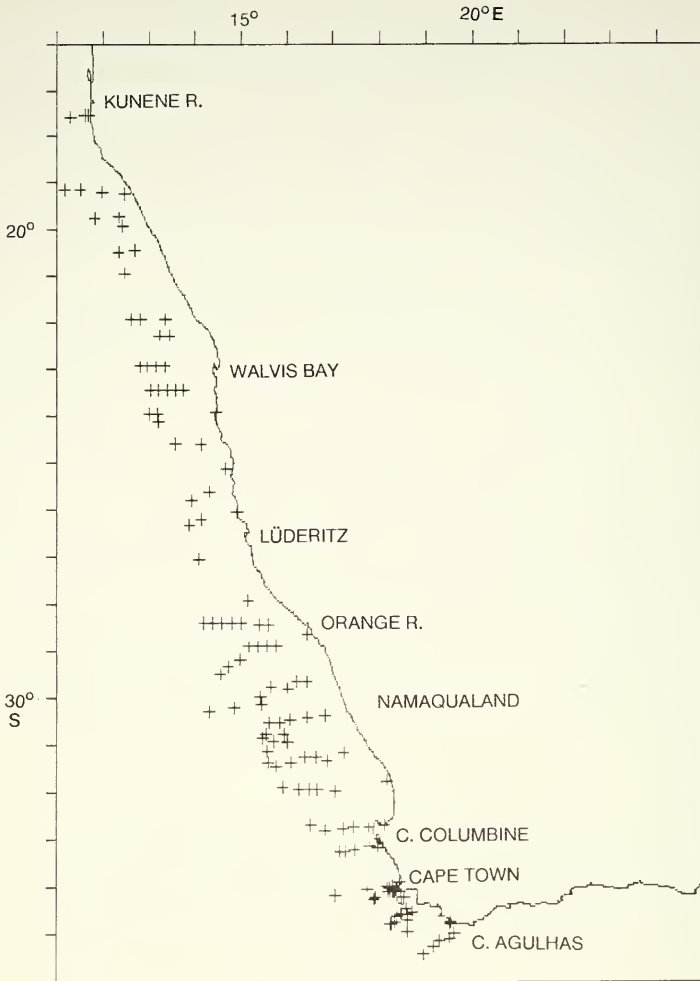


Fig. 1. Ostracod-bearing samples (134) with minor taxa from water depths less than 950 m along the continental margin off south-western Africa.

A summary of the bathymetric and oceanographic setting of the continental margin off south-western Africa, as well as an account of previous ostracod studies from this, and adjacent regions, can be found in Part I (Dingle 1992).

The 104 minor taxa and their numerical distribution within the sediment samples are listed in Table 1. Although these species constitute a relatively small proportion of the total ostracod populations, they vary considerably in their abundance locally. This is illustrated by considering the depth distribution of the minor taxa expressed as mean percentages of the total fauna. Figure 2 (which is based on the 134 samples in which these species occur, and not the total sample set), shows that the minor taxa are relatively more important (35%) in nearshore areas (< 90 m), and on the outermost shelf and uppermost

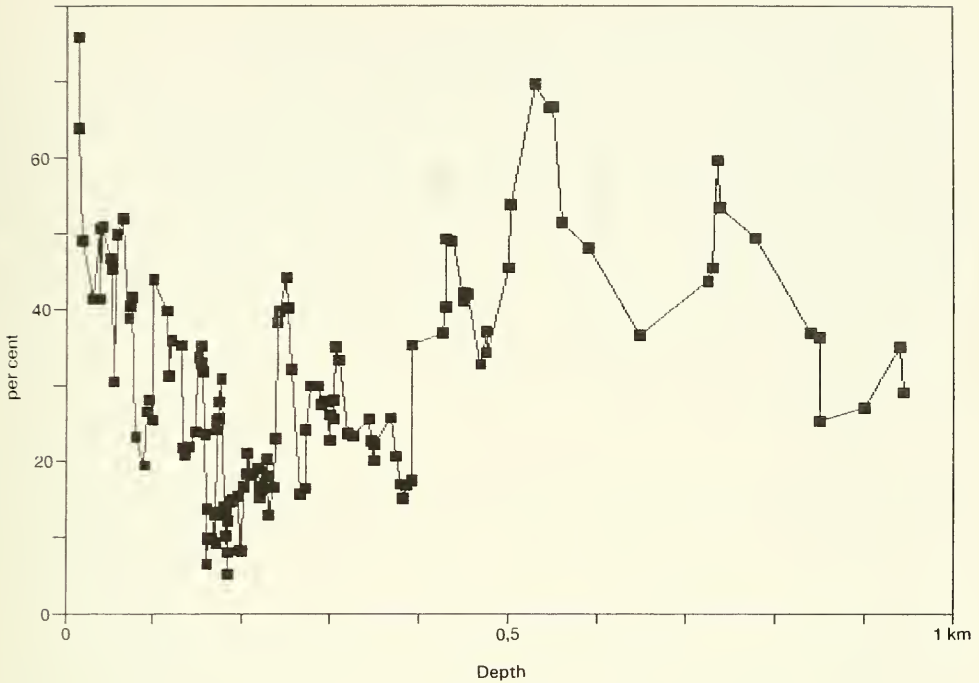


Fig. 2. Distribution with depth across the continental margin of south-western Africa of the combined abundances of the minor species (five-point running mean of percentage of total ostracod fauna).

slope (400–800 m). The mid-shelf areas (90–400 m) are populated predominantly by the eighteen dominant taxa described in Part I.

As discussed in Part I, an assessment has been made of the proportions of modern (i.e. living or recently dead) and relict valves. In the sections dealing with the distribution of individual taxa this information is used to identify possible differences in modern and post-glacial faunas.

The genera of Ostracoda discussed in Part II are given below:

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SYSTEMATIC DESCRIPTIONS

The classification used here is based on Moore (1961), with various additions necessitated by subsequent work.

Abbreviations used: AM = anterior margin; ATE = anterior terminal element; C = carapace; CA = cardinal angle; DM = dorsal margin; LV = left valve; MA = marginal area; ME = median element; MPC = marginal pore canal; MS = muscle scars; NPC = normal pore canal; PM = posterior margin; PTE = posterior terminal element; RV = right valve; SCT = subcentral tubercle; VM = ventral margin.

In the discussion of ostracod distributions, UDL and LDL indicate upper depth limit and lower depth limit, respectively. Specimen numbers are given as valves, i.e. 1 carapace = 2 valves.

Type and illustrated specimens are housed at the South African Museum under catalogue numbers prefixed SAM-PQ-MF-.

Class CRUSTACEA Pennant, 1777

Subclass OSTRACODA Latreille, 1806

Order PODOCOPIDA Müller, 1894

Suborder PLATYCOPINA Sars, 1866

Family **Cytherellidae** Sars, 1866

Genus *Cytherelloidea* Alexander, 1929

Cytherelloidea compuncta sp. nov.

Fig. 3A–B

Derivation of name

Notis compungere—Latin, tattoo; fanciful reference to ornamentation.

Holotype

	length	height
MF-0691, LV, TBD 344, 73 m	0,49	0,29

Material

One valve.

Diagnosis

Species of *Cytherelloidea* with fine, delicate punctations in lozenge-shaped groups on elevated surface features, and coarse, circular intercostal pits.

Description

External features. AM broadly and symmetrically rounded, PM rounded, somewhat truncated, with more gently sloping posterodorsal outline. The posteroventral and ventrolateral parts of the valve are inflated, and there is a continuous ridge in the form of a concave loop along the crest of the inflated area. This ridge passes ventral to the MS area, the structure of which is clearly visible in external view. A further low, irregular, elevated area extends from the anterodorsal part of the loop towards the DM, where it is deflected posteriorly, so that the MS area is almost encircled by ridges. The AM has a narrow ridge that extends short distances along the DM and VM. The narrow, elevated areas of the valve are ornamented with fine puncta arranged in lozenge-shaped clusters, which resemble delicate, tattoo-like patterns. Intercostal areas have larger, circular pits.

Internal features are typical for the genus.

Remarks

The ornamentation of *Cytherelloidea compuncta* is very distinctive and cannot be confused with previously described species. Because of this, I feel confident of erecting a new species on the basis of a single valve. *Cytherelloidea lobitoensis* Hartmann, 1974, has a partially developed loop in the central valve area, but lacks an anterior closure. None of the several Cretaceous species from southern Africa has similar ornamentation.

Distribution

Record of this species is confined to one site (TBD 344) in 73 m, immediately west of Cape Agulhas. No other specimens of the genus have been recovered from the west-coast shelf between this locality and Benguela in Angola, where Hartmann (1974) recorded *Cytherelloidea lobitoensis* in coarse sand. Keeler (1981) reported a single valve from TBD 1259 (91 m) on the eastern Agulhas Bank, and referred it to *Cytherelloidea* aff. *C. keiji* McKenzie, 1967 (from south-east Australia). This specimen is not conspecific with our material.

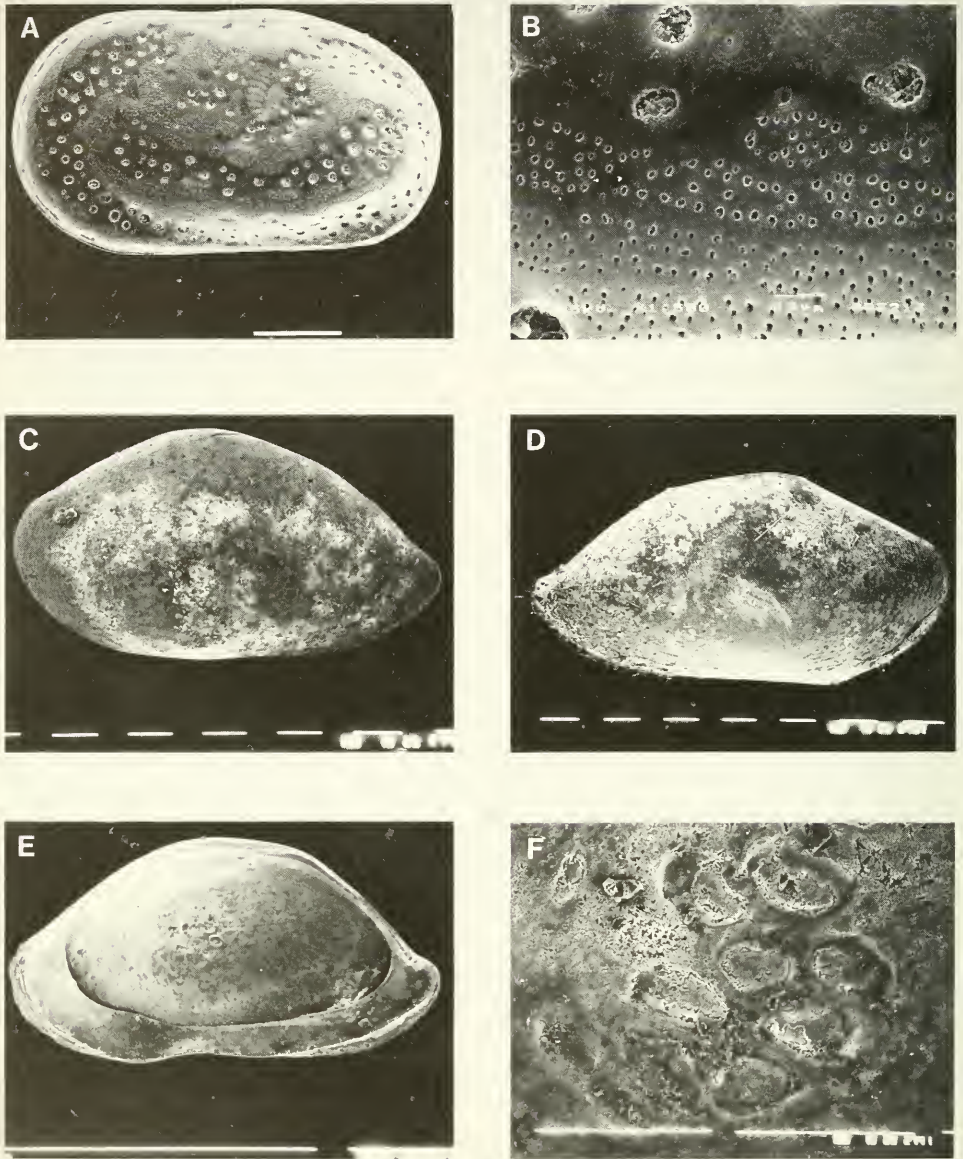


Fig. 3. A–B. *Cytherelloidea compuncta* sp. nov., holotype, MF-0691, LV, TBD 344, 73 m. A. SEM 3211. B. Detail of ornamentation, SEM 3213. C–F. *Bairdoppilata simplex* (Brady, 1880). C. MF-0593, LV, TBD 6824, 90 m. SEM 2747. D. MF-0594, TBD 6846, 95 m, SEM 2735. E–F. MF-0595, RV, TBD 6846. E. Internal view, SEM 2739. F. MS, SEM 2741. Scales: A, C–D, F = 100 μ , C = 10 μ , E = 1 000 μ .

The excellent state of preservation of the valve suggests that it is modern, and not reworked from older sediments.

Suborder *PODOCOPIDA* Sars, 1866
 Superfamily *BAIRDIACEA* Sars, 1888
 Family ***Bairdiidae*** Sars, 1887

Genus *Bairdoppilata* Coryell, Sample & Jennings, 1935

This genus has a long history in southern Africa. It first appeared in the Santonian (Dingle 1985), and locally became a dominant element in the Campanian and Maastichtian faunas of Zululand (Dingle 1981). It is abundant at various levels of the Palaeogene in the J(c)-1 borehole off Natal (Dingle 1976) but, as it was not one of the taxa studied by Frewin (1987), no data are available on its presence in the Tertiary of the Agulhas Bank.

Bairdoppilata simplex (Brady, 1880)

Figs 3C-F, 6A-B

- Bairdia ovata?* Bosquet, 1854. Brady, 1880: 53-54, pl. 7 (figs 3a-d).
Bairdia simplex Brady, 1880: 51, pl. 7 (figs 1a-d). Puri & Hulings, 1976: 266, pl. 3 (figs 11-14).
Nesidea labiata Müller, 1908: 99, pl. 14 (figs 1-6).
Bairdia villosa? Brady, 1880. Benson & Maddocks, 1964: 14-15, pl. 1 (figs 3, 6, 8).
Bairdoppilata (Bairdoppilata?) simplex (Brady, 1880) Maddocks, 1969b: 77-78, text-fig. 42.
 ?*Bairdoppilata* sp. 44 Hartmann, 1974: 253-254, pl. 23 (figs 168-169).
Bairdoppilata sp. aff. *B. (B.) villosa* (Brady, 1880) Keeler, 1981: 24-26, pl. 1 (figs 1-2).
Bairdia spp. Boomer, 1985: 14-15, pl. 2 (figs 19-20).

Illustrated material

	length	height
MF-593, LV, TBD 6824, 90 m	0,90	0,50
MF-594, RV, TBD 6846, 95 m	1,10	0,56
MF-595, RV, TBD 6846, 95 m	0,64	0,35

Material

434 valves.

Remarks

This species was originally recorded from the 'Challenger' station in False Bay by Brady (1880) as *Bairdia ovata?*, whereas Maddocks (1969b) recorded four specimens from False Bay in her monograph on Recent Bairdiidae. Benson & Maddocks (1964) illustrated a specimen of *Bairdoppilata* from Knysna Lagoon which they placed in *Bairdia villosa?* Brady, 1880.

Bairdoppilata simplex is very similar to *B. villosa* (Brady, 1880) and, in fact, Brady (1880) remarked that the main criterion he used in differentiating the two was the larger size and more elongate outline of *B. simplex*. Our material is very close to the outline of the lectotypes of the latter species and contrasts with the strongly arched DM of the lectotypes of *B. villosa* (Puri & Hulings 1976). I consider the outline of the specimens illustrated by Benson & Maddocks (1964) also to be closer to *B. simplex*.

Hartmann (1974) recovered four species of *Bairdoppilata* from the coast of Angola, and one species from a rock pool at Lüderitz. The latter (*Bairdoppilata* sp. 44) has a MS pattern that is very similar to my material, and a valve outline that falls within its intra-specific variation. Although Hartmann's species has a smooth hinge, I suspect that this species is also *B. simplex*, because juvenile specimens in my material invariably have smooth hinges.

Bairdoppilata simplex occurs in the Southern Ocean (Heard Island), the Antarctic Peninsula, and southern Africa.

Distribution

Bairdoppilata simplex is a relatively abundant species (1,7% of total fauna) that is confined to areas south of 22°S, and extends to the eastern Agulhas Bank (Keeler 1981) and Knysna (Benson & Maddocks 1964) (Fig. 4).

Modern populations occur between Namaqualand and Cape Agulhas, where the UDL and LDL are 15 m and 205 m, respectively (Fig. 5A).

Relict populations extend the range of the species to the Walvis Bay area, but there is a dearth of sites on the inner shelf north of St Helena Bay (Fig. 4A). Hartmann (1974) probably recorded the species from a shore site at Lüderitz. The depth limits vary from

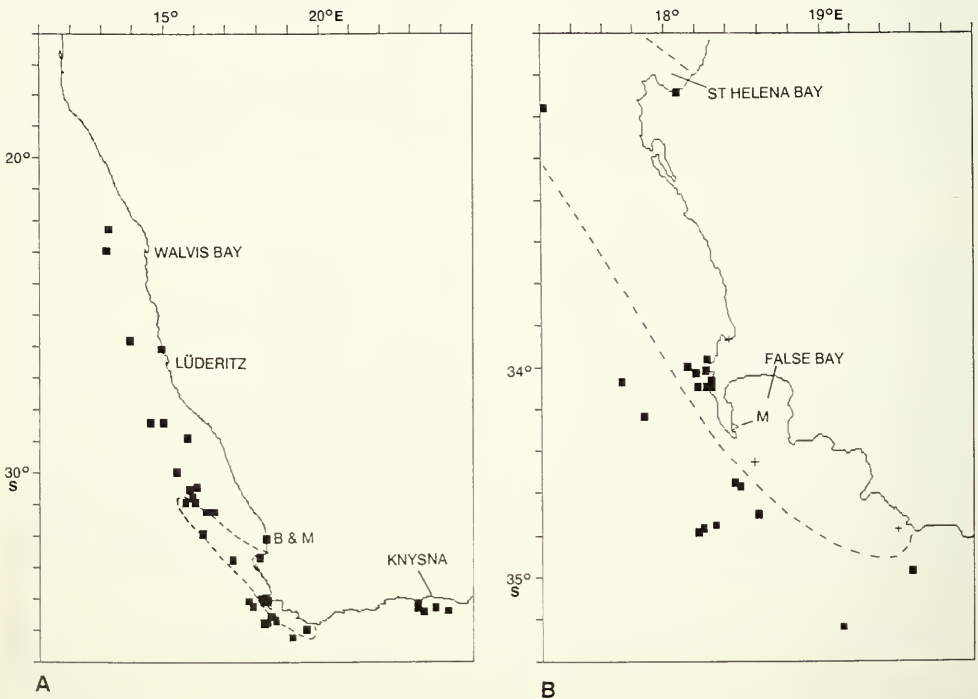


Fig. 4. Distribution of *Bairdoppilata simplex* (Brady, 1880) on the continental shelf off south-western Africa (A), and off the south-western Cape (B). Sites with modern specimens are enclosed by dashed lines. Sites in the vicinity of Knysna (A) are from Keeler (1981); B & M = Benson & Maddock's (1964) site; M = Maddock's (1969b) site GIL 615.

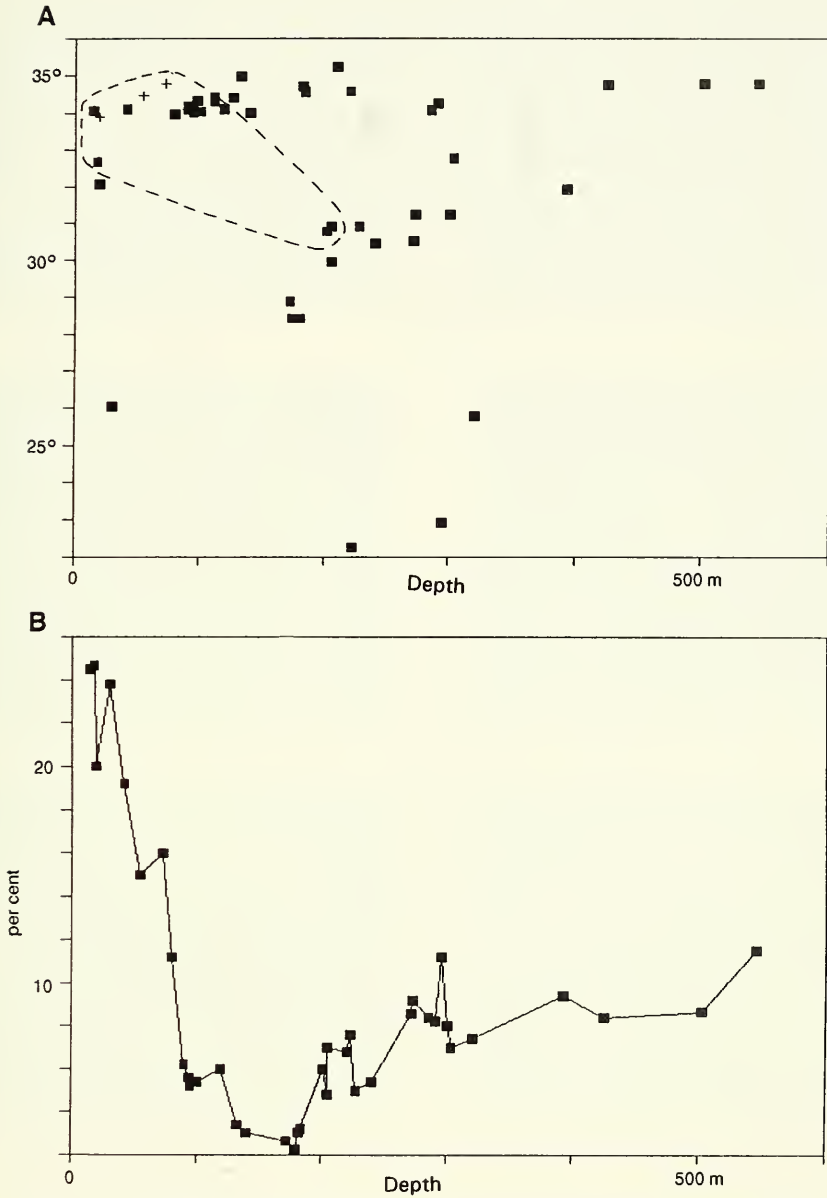


Fig. 5. A. Latitudinal water-depth distribution of *Bairdoppilata simplex* (Brady, 1880). Modern specimens occur at sites with crosses (enclosed by dashed line). B. Abundance of *Bairdoppilata simplex* as percentage of ostracod fauna plotted against water depth (five-point running mean).

north to south as follows: UDL 172 m (N) to 15 m (S), and LDL 392 m (N) to 545 m (S).

Across-shelf abundance of *B. simplex* reaches a maximum inshore of 100 m (20%, Fig. 5B). There is an abundance low between 100 m and 200 m, and a general increase in values with increasing water depth on the outer shelf and upper slope.

Superfamily CYPRIDACEA Baird, 1845

Family **Macrocyprididae** Müller, 1912

Genus *Macrocypris* Brady, 1867

Macrocypris cf. *M. metuenda* Maddocks, 1990

Fig. 6C, 7

Macrocypris sp. Boomer, 1985: 17–18, pl. 3 (figs 46–47).

Illustrated material

	length	height
MF-0799, RV, TBD 2472, 201 m	2.91	1.14
MF-0800, RV, TBD 2472, 201 m	2.63	1.14

Material

103 valves.

Remarks

In her revision of the Macrocyprididae, Maddocks (1990) distinguished two large species of the genus off south-western Africa: *Macrocypris metuenda* sp. nov. and *M. miranda* sp. nov. My material is closer to the former by virtue of its more strongly arched DM, but differs from it on details of MS and in being somewhat smaller in size. Maddocks (1990) suspected that *M. metuenda* is the largest living macrocyprid, and possible podocopid ostracod, and quoted a size range for adults of between 2 800 μ and 3 750 μ . My largest specimen is 2 910 μ , whereas two other complete adults measure 2 630 and 2 500 μ . In addition, Maddocks (1990) reported the species from water depths of 700–3 800 m, whereas almost all my specimens are from shallower depths. I suspect that my material represents a shallower-water variant of Maddock's species or, more likely, a very closely related but separate species.

Adult valves of my species are fragile (of the 103 valves recovered, only three were complete) and rare. Instars, which form the bulk of the material available, have generally more rounded posteroventral areas, although some have a distinct point.

Distribution

With one exception (a valve fragment at TBD 3769, north-west of Walvis Bay), all records of this species are from south of 28°S (Fig. 8). Adult specimens are particularly large and fragile, and whole valves were recovered at only two sites, both on the Orange–Namaqualand shelf. Keeler (1981) did not record this species on the eastern Agulhas Bank, so its eastern limit must lie somewhere between 20° and 23°E.

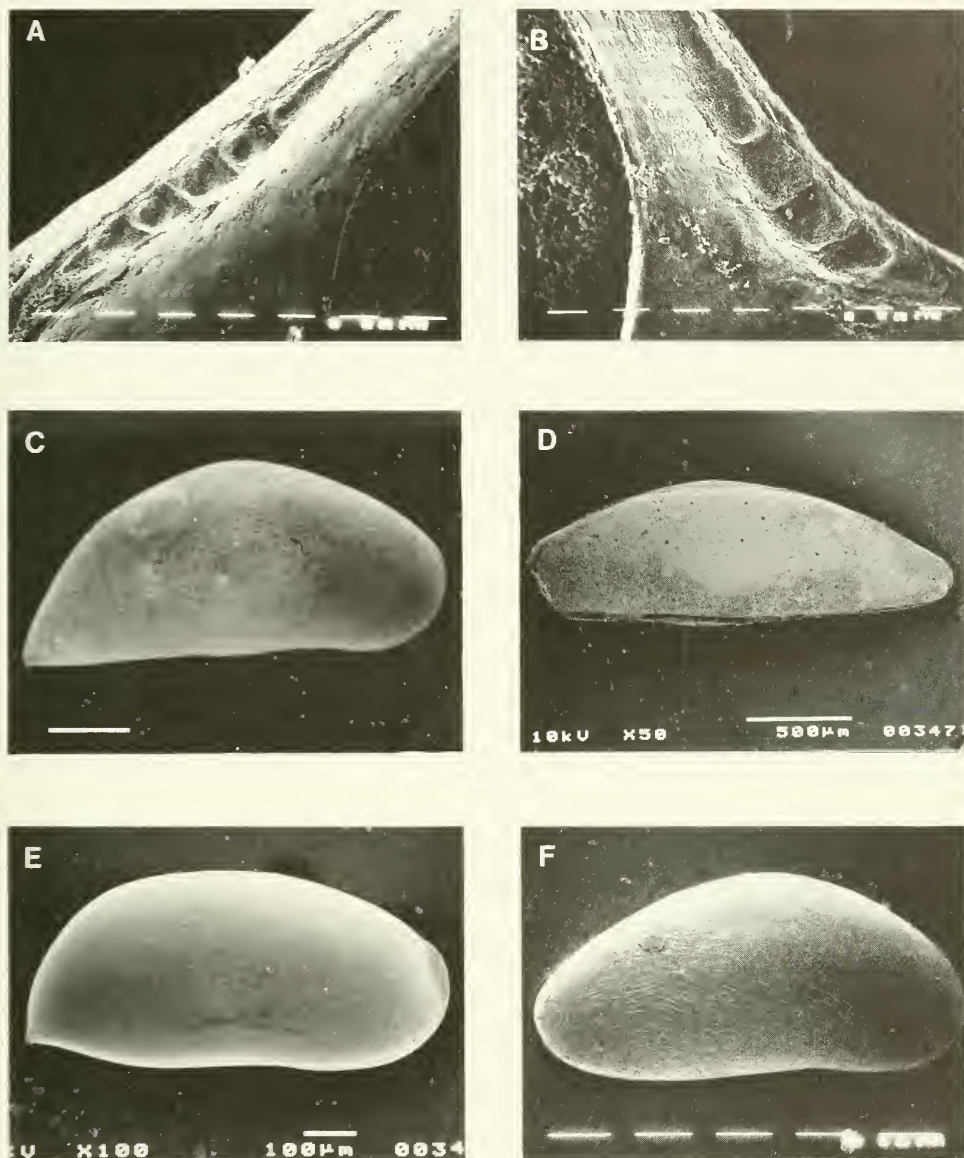


Fig. 6. A–B. *Bairdoppilata simplex* (Brady, 1880), MF-0595, RV, TBD 6846, 95 m. A. ATE, SEM 2743. B. PTE, SEM 2742. C. *Macrocypris* cf. *M. metuenda* Maddocks, 1990, MF-0800, RV, TBD 2472, 201 m. Photograph from Boomer 1985, pl. 3 (fig. 46). D. *Macrocypris* sp. 3471, MF-0766, C, TBD 2222, 155 m, right view, SEM 3471. E. *Argilloecia* sp. 3483, MF-0771, RV, TBD 3179, 437 m, SEM 3483. F. *Propontocypris* cf. *P. (Propontocypris) subreniformis* (Brady, 1880), MF-0596, RV, TBD 3320, 72 m, SEM 2990. Scales: A–B = 10 μ , C, E–F = 100 μ , D = 500 μ .



Fig. 7. Muscle scars of *Macrocypris* cf. *M. metuenda* Maddocks, 1990, MF-0799, RV, TBD 2477, 201 m. Edges of depressed area are dotted. Scale = 200 μ .

Modern juveniles occur at several sites between the Cape Peninsula and Cape Agulhas, and cluster in the shallow areas, where they have UDL and LDL of 15 m and 133 m, respectively.

Relict specimens have a wider latitudinal distribution, and occur over the depth range 15–736 m. The UDL north of 31°S is *c.* 200 m.

Genus *Macrocypris* Sars, 1923

Macrocypris sp. 3471

Fig. 6D

Illustrated material

	length	height
MF-0766, C, TBD 2222, 155 m	2,00	0,70

Material

Five valves.

Remarks

This species is placed within *Macrocypris* on the basis of its elongate shape and large size (2 000 μ). According to the Cologne Index (Kempf 1986), the only other named Quaternary species is the type, *M. angusta* (Sars), from Scandinavian waters, although Maddocks (1979) mentioned at least three new extant species from the Atlantic. Whatley & Downing (1984) have reported a further species (*M. elegantula*) from the Middle Miocene of south-east Australia. *Macrocypris* sp. 3471 is closer to Sars's type than to the Australian form.

Distribution

This rare species was recovered relict from three sites (TBD 2222: 155 m; TBD 2459: 300 m; TBD 2260: 303 m) from the outer shelf off Lüderitz and Namaqualand, and from the middle shelf west of Saldanha Bay.

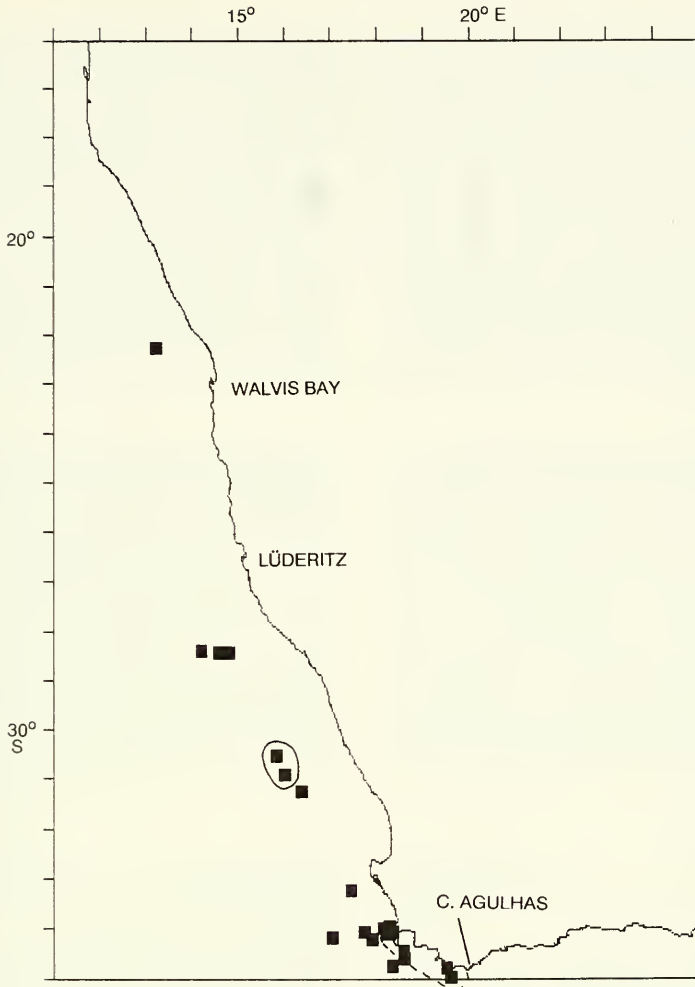


Fig. 8. Distribution of *Macrocypris* cf. *M. metuenda* Maddocks, 1990, on the continental margin off south-western Africa. Sites with adult specimens are enclosed by a solid line, and sites with modern specimens are enclosed by a dashed line.

Family **Pontocyprididae** Müller, 1894

Genus *Argilloecia* Sars, 1866

Argilloecia sp. 3483

Fig. 6E

Illustrated material

	length	height
MF-0771, RV, TBD 3179, 437 m	0,74	0,35

Material

Fourteen valves.

Remarks

This fragile, elegant species is characterized by a small compressed lip on the dorsal part of the AM, and a small, nipple-like projection at the posteroventral corner. It is probably a new species, but none of my specimens had well-preserved interior features.

Distribution

This relatively rare species was recovered from seven sites on the upper continental slope, between latitudes 23.4° and 34.7°S. Specimens have the following UDL and LDL, respectively: 437 m and 900 m (modern), and 450 m and 725 m (relict).

Genus *Propontocypris* Sylvester-Bradley, 1947

Subgenus *Propontocypris* (*Propontocypris*) Sylvester-Bradley, 1947

Propontocypris cf. *P. (P.) subreniformis* (Brady, 1880)

Figs 6F, 9A, 10

Pontocypris (?) *subreniformis* Brady, 1880: 38–39, pl. 7 (figs 5a–d). Puri & Hulings, 1976: 259–259, pl. 3 (fig. 16).

Propontocypris sp. A Keeler, 1981: 37–38, pl. 1 (fig. 18).

Illustrated material

	length	height
MF-596, RV, TBD 3320, 72 m	0,70	0,33
MF-597, RV, TBD 3320, 72 m	0,70	0,33
MF-598, LV, TBD 6846, 95 m	0,67	0,31

Material

66 valves.

Remarks

In his original account of the ‘Challenger’ collection, Brady (1880) claimed to have found *Pontocypris* (?) *subreniformis* in False Bay (South Africa) and at Port Jackson (Australia). He illustrated two carapaces—*P. subreniformis* (pl. 7 (fig. 5a–d)) and *P. (?) subtriangularis* (pl. 15 (fig. 6a–d)) but, in the description, referred to only one illustration, the nomen nudum *P. (?) subtriangularis* (Maddocks 1969a). Puri & Hulings (1976) designated the lectotype of *Pontocypris* (?) *subreniformis* as a specimen from Port Jackson. Because Brady (1880) did not note the provenance of the two carapaces that he illustrated, there is no record of the material that he cited from False Bay. Maddocks (1969a) speculated that the carapace labelled *P. (?) subtriangularis* could be a specimen from False Bay, but there is no proof. My material is closest to Brady’s pl. 7 (fig. 5a–d), which is referred to the lectotype from Port Jackson by Puri & Hulings (1976) (Fig. 10).

Although I have isolated 65 valves, none are well-preserved adults with good internal views. Most specimens retain a coating of very fine hairs, which give the valves an opalescent appearance. The dorsal margin is less angular than some of the species placed in *Propontocypris* by Maddocks (1969a), but the overall outline of my material is very similar to the lectotype and has a MS pattern consisting of five scars in three horizontal rows. Maddocks (1969a: 17) was satisfied that the lectotype of *P. (?) subreniformis*

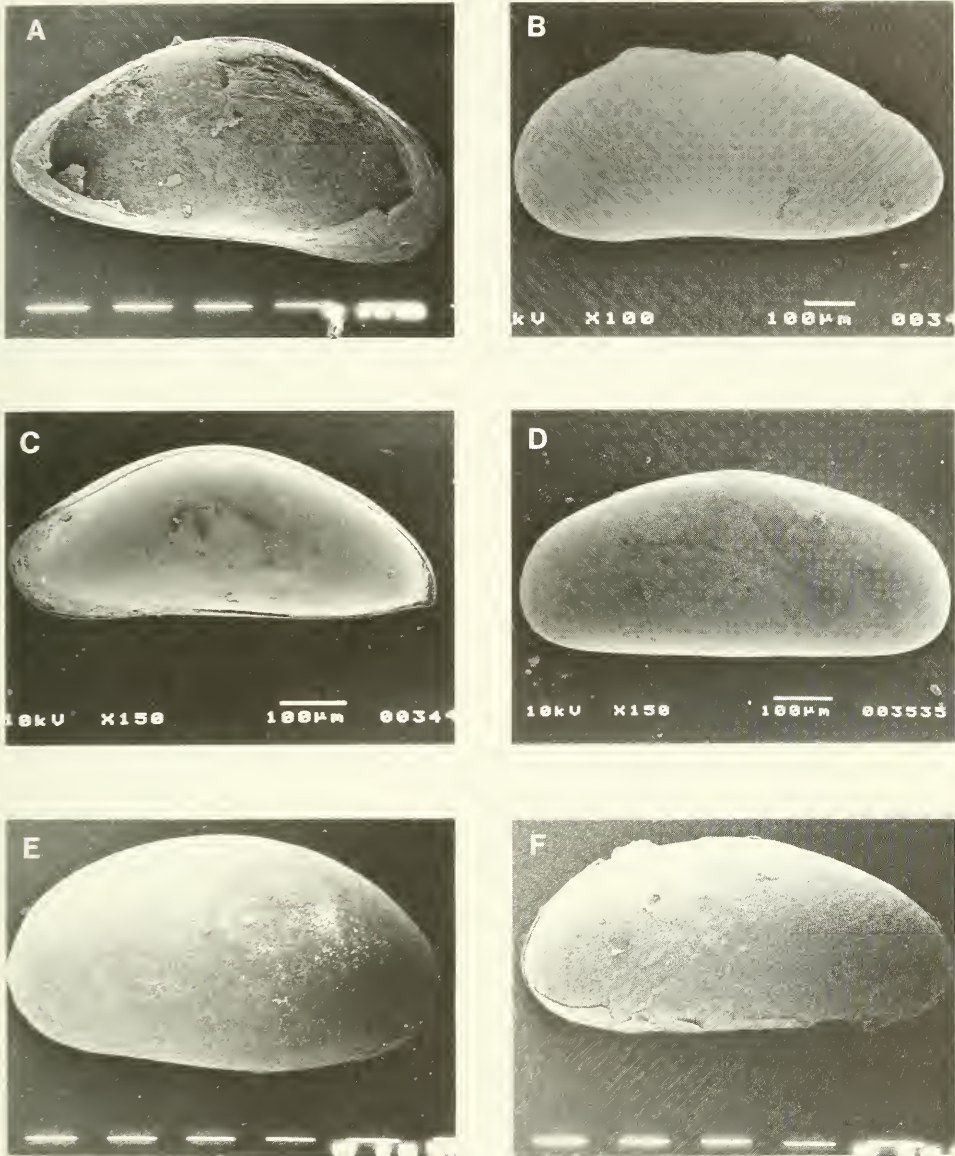


Fig. 9. A. *Propontocypris* cf. *P. (Propontocypris) subreniformis* (Brady, 1880), MF-0597, LV, TBD 3320, 72 m, internal view, SEM 3000. B. *Propontocypris* (?*Propontocypris*) sp. 3434, MF-0739, LV, TBD 6836, 80 m, SEM 3434. C. *Propontocypris* (?*Epropontocypris*) sp. 3445, MF-0757, C, TBD 6846, 95 m, left view, SEM 3445. D. *Propontocypris* (?*Schedopontocypris*) sp. 3535, MF-0747, RV, TBD 6824, 90 m, SEM 3535. E-F. *Australoecia fulleri* sp. nov., TBD 6846, 95 m. E. Holotype, MF-0599, LV, SEM 3049. F. Paratype, MF-0600, RV, SEM 3051. Scales: all 100 μ .

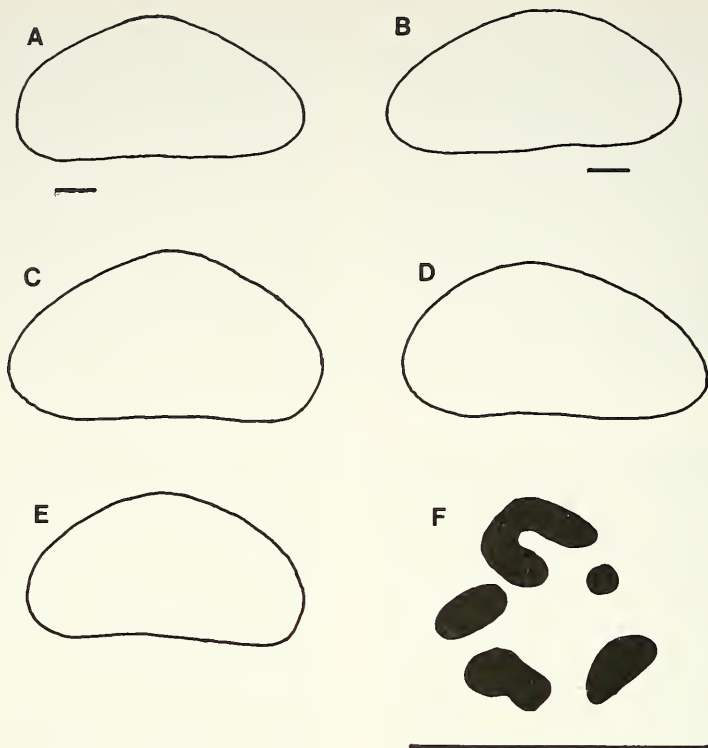


Fig. 10. Outlines of species of *Propontocypris*. A–B. *Propontocypris* cf. *P. (Propontocypris) subreniformis* (Brady, 1880). A. MF-0597, LV, TBD 3320, 72 m. B. MF-0598, RV, TBD 6846, 95 m. C. *Propontocypris (Propontocypris) subreniformis* (Brady, 1880), lectotype, RV, BM 81.5.5 (Puri & Hulings 1976, pl. 3 (fig. 16)), Port Jackson, Australia. D. *Pontocypris subreniformis* sp. nov. Brady, 1880, pl. 7 (fig. 5a), LV, locality unknown. E. *Pontocypris 'subtriangularis'* sp. nov. Brady, 1880, pl. 15 (fig. 6a), LV, locality unknown. F. *Propontocypris* cf. *P. (Propontocypris) subreniformis* (Brady, 1880), MF-0598, RV, TBD 6846, 95 m, MS. Scales: all 100 μ .

belonged to this genus, and consequently there is no justification for placing Brady's (1880) material in *Ekpontocypris* as she suggested. The only hesitation that I have in suggesting that my material is conspecific with *Propontocypris (P.) subreniformis* is the slightly more elongate shape of the adults from southern Africa (length : height ratio >2.0) compared to the lectotype (1.96).

Distribution

Propontocypris cf. *P. (P.) subreniformis* (Brady) occurs at several sites around the Cape Peninsula (including False Bay), and at a small number of sites along the west-coast shelf, as far north as 19,7°S (Fig. 11). Keeler (1981) recorded the species from the eastern Agulhas Bank.

Modern specimens were recovered from all areas except the northernmost site on the Walvis Ridge abutment shelf (TBD 3940), and have UDL and LDL of 18 m to 120 m.

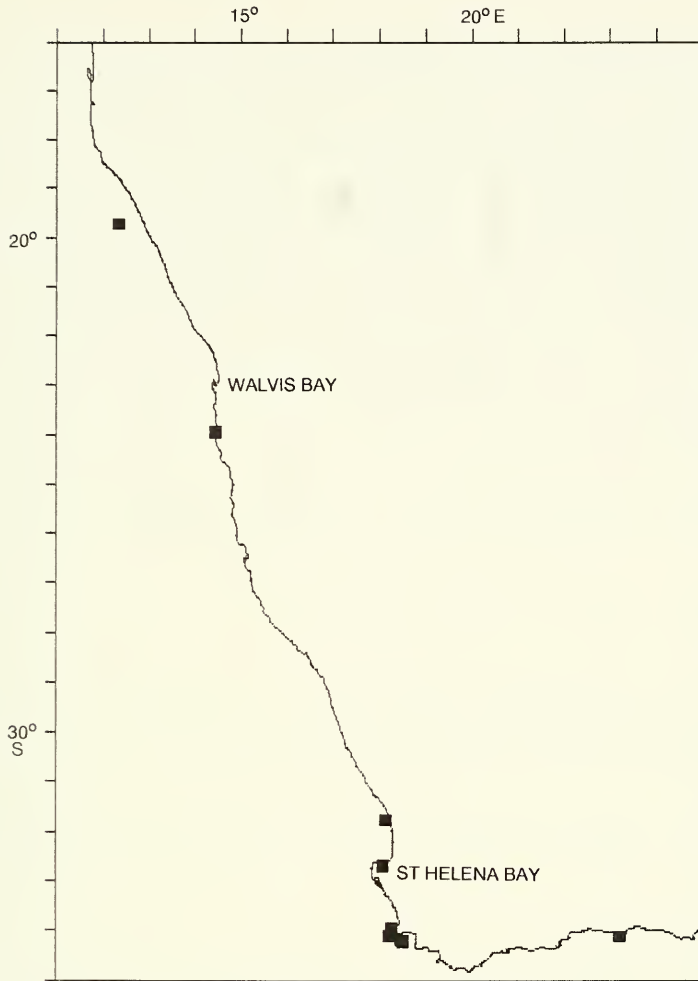


Fig. 11. Distribution of *Propontocypris* cf. *P. (Propontocypris) subreniformis* (Brady, 1880) on the continental shelf off south-western Africa.

Relict specimens are less abundant, and have UDL and LDL of 72 m and 184 m, respectively.

Propontocypris (?*Propontocypris*) sp. 3434

Fig. 9B

Illustrated material

	length	height
MF-0739, RV, TBD 6836, 80 m	0,80	?

Material

One valve.

Remarks

This large, probably new species was represented by one broken valve.

Distribution

Propontocypris (?*P.*) sp. 3434 was recovered from one site only (TBD 6836: 80 m) west of the Cape Peninsula.

Subgenus *Propontocypris* (*Ekpontocypris*) Maddocks, 1969a

Propontocypris (?*Ekpontocypris*) sp. 3445

Fig. 9C

Illustrated material

	length	height
MF-0757, C, TBD 6846, 95 m	0,63	0,26

Material

Two valves.

Remarks

Confident generic assignment of this species is not possible until internal features can be investigated.

Distribution

One modern carapace was recovered from site TBD 6846 (95 m), west of the Cape Peninsula.

Subgenus *Propontocypris* (*Schedopontocypris*) Maddocks, 1969a

Propontocypris (?*Schedopontocypris*) sp. 3535

Fig. 9D

Illustrated material

	length	height
MF-0747, RV, TBD 6824, 90 m	0,70	0,30

Material

One valve.

Remarks

This species is less compressed than the original diagnosis allowed, but the inner lamella, MS and lateral outline appear to conform to what was considered by Maddocks (1969a: 37) to be a less-coherent group than the other subgenera of *Propontocypris*.

Distribution

This very rare species occurred as a modern valve at one site only (TBD 6824: 90 m), west of the Cape Peninsula.

Genus *Australoecia* McKenzie, 1967

This genus has a long history in the area of the Southern Ocean (Upper Cretaceous to Recent), whence most of the species recorded in the Marine Ostracoda Index have been reported (Kempf 1986—four referred to the synonymous *Abyssoocypris* occur in the Northern Hemisphere).

Four species of *Australoecia* are known from south-western and southern Africa, two of which fall into the group with evenly rounded PM (*A. richardsbayensis* (Dingle, 1980), Upper Cretaceous of south-east Africa; *A. fulleri* sp. nov., Quaternary continental margin), with the other two having distinct posteroventral corners (*A. abyssophilia* Maddocks, 1969a, Quaternary Mozambique Channel; *Australoecia* sp. (= *Argilloecia*) (Van den Bold 1966), Lower Miocene of Gabon). In the modern faunas, Maddocks (1977a) considered these two categories to represent 'shallow' and 'deep' water taxa, respectively.

Australoecia fulleri sp. nov.

Figs 9E–F, 12A–C, 13

Derivation of name

This species is named for Professor A. O. Fuller (University of Cape Town), who undertook the first marine geological sampling surveys off southern Africa.

Holotype

	length	height
MF-599, LV, TBD 6846, 95 m	0,80	0,45

Paratypes

	length	height	width
MF-600, RV, TBD 6846, 95 m	0,79	0,37	
MF-601, LV, TBD 6846, 95 m	0,90	0,50	
MF-602, RV, TBD 6847, 94 m	0,80	0,40	
MF-603, C, TBD 6847, 94 m	0,83		0,40

Material

96 valves.

Diagnosis

Species of *Australoecia* with elongate ovate outline, in which there is a subtle but distinct VM concavity in both valves at about one-quarter length. In internal view, the RV DM is straight, with postero- and anterodorsal angles.

Description

External features. Elongate ovate outline. Robust, thick shelled. Valves are a creamy colour with a glossy surface that is prone to flaking and rapid deterioration. RV more

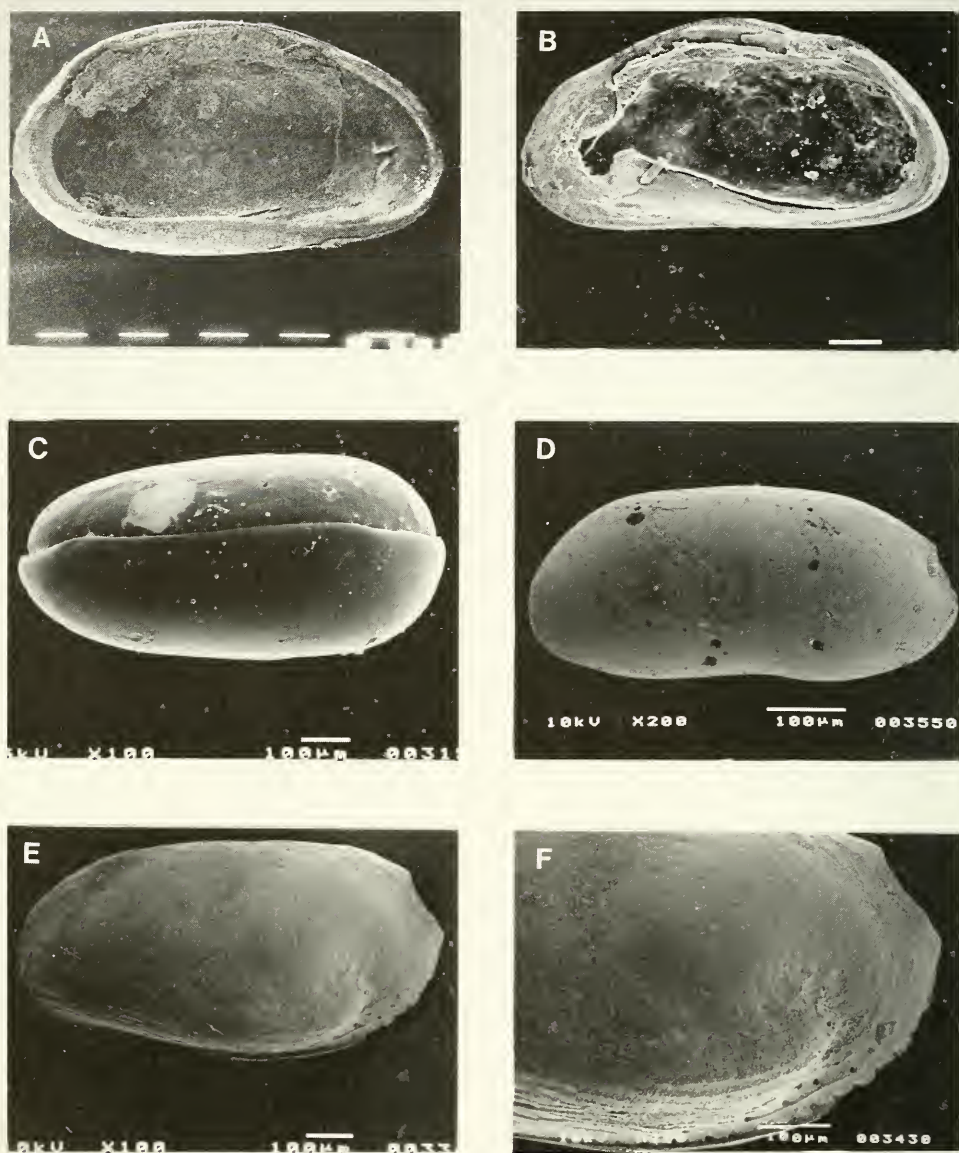


Fig. 12. A-C. *Australoecia fulleri* sp. nov., paratypes. A. MF-0601, LV, TBD 6846, 95 m, internal view, SEM 3053. B. MF-0602, RV, TBD 6847, 94 m, internal view, SEM 3153. C. MF-0603, C, TBD 6847, 94 m, dorsal view, SEM 3158. D. ?*Australoecia* sp. 3550, MF-0775, RV, TBD 1689, 182 m, SEM 3550. E-F. *Bythocythere* sp. 3349, MF-0740, LV, TBD 6824, 90 m. E. SEM 3349. F. Detail of posteroventral area, SEM 3438. Scales: all 100 μ .



Fig. 13. *Australoecia fulleri* sp. nov., MF-0602, RV, TBD 6847, 94 m, internal view, MS, SEM 3156. Scale: 50 μ .

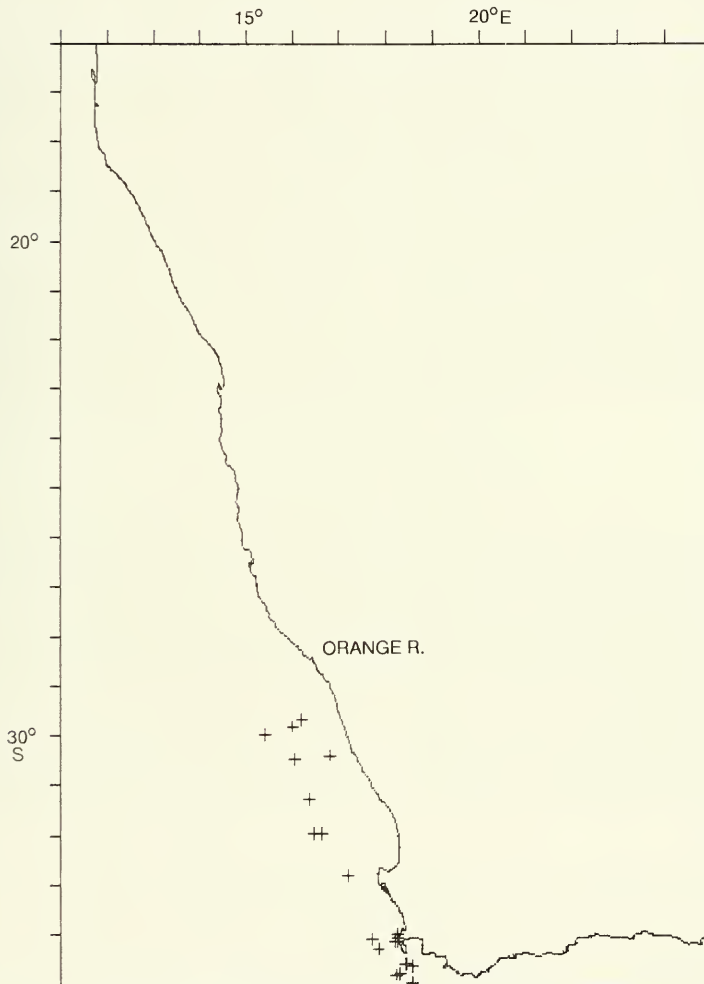


Fig. 14. Distribution of *Australoecia fulleri* sp. nov. on the continental shelf off south-western Africa.

elongate than LV, with the latter conspicuously larger and more ovate. AM and PM broadly rounded. DM broadly convex, more so in LV. VM almost straight, with gentle convexity in posterior half, and slight concavity at one-quarter length.

Internal features. There is a conspicuous brown chitinous lining to the shells. LV DM is gently convex, with a relatively high posterodorsal outline, in contrast to the posteriorly sloping, straight RV DM with distinct antero- and posterodorsal angles. The outline of the AM inner lamella is bulbous, with a narrow central neck and large antero-dorsal and anteroventral lobes. Vestibulae are small, but RPC could not be seen. There are five large, ovate MS.

Remarks

The type species is *Australoecia victoriensis* McKenzie, 1967, from the Recent of coastal Victoria, southern Australia. It differs from *A. fulleri* in being more elongate, and having relatively much larger MS (of a slightly different pattern). A species closer to *A. fulleri* is *A. mckenziei* Maddocks, 1969a, also from coastal southern Australia. However, the latter is a significantly larger species that lacks the straight interior LV DM outline of *A. fulleri* and, in consequence, has a more broadly round PM. The MS of *A. mckenziei* are larger than those of the new species.

Australoecia fulleri sp. nov. and *A. richardsbayensis* (Dingle, 1980), originally referred to *Bythocypris richardsbayensis*, are remarkably close, given the known stratigraphic range of the latter (Coniacian to Maastrichtian). The main differences are in size (*A. richardsbayensis* is significantly smaller), in the more drawn out PM LV outline, and more broadly rounded PM RV outline of *A. richardsbayensis*. It would be remarkable if *A. fulleri* is not a direct descendant of *A. richardsbayensis*, although no evidence to support this was available from the Palaeogene fauna from Natal (Dingle 1976).

In his ecological assessment of the Upper Cretaceous of Zululand, Dingle (1981) used the presence of *A. richardsbayensis* as an indicator of moderate to deep-water environments (mid-shelf to upper slope).

Distribution

Australoecia fulleri is confined to areas south of 29.6°S, and was not recorded by Keeler (1981) from the Agulhas Bank (Fig. 14).

Modern specimens are confined to three sites west of the Cape Peninsula (80–95 m).

Relict specimens off the south-western Cape have UDL and LDL of 80 m and 545 m, respectively, whereas north of Cape Columbine they have a more restricted depth range (170–350 m).

Although *A. fulleri* is a relatively rare species (0.38% of total fauna), it locally becomes more abundant in the outer-shelf and upper-slope populations (>1% in water >220 m).

?*Australoecia* sp. 3550

Fig. 12D

Illustrated material

	length	height
MF-0775, RV, TBD 1689, 182 m	0,53	0,24

Material

One valve.

Remarks

A relict valve of a cylindrically-shaped species. The internal features are poorly preserved and the generic status is uncertain.

Distribution

This very rare species was recovered from one site only (TBD 1689: 182 m) on the outer shelf south of Cape Hangklip.

Superfamily CYTHERACEA Baird, 1845

Family **Bythocytheridae** Sars, 1926

Genus *Bythocythere* Sars, 1866

Bythocythere sp. 3349

Figs 12E–F, 15A–B

Illustrated material

	length	height
MF-0740, LV, TBD 6824, 90 m	0,90	0,45

Material

Seven valves.

Remarks

This new species is thin shelled and fragile, and all the specimens are relict and poorly preserved. In particular, the outer valve surface corrodes easily. In valve outline, *Bythocythere* sp. 3349 is similar to *B. robinsoni* Athersuch, Horne & Whittaker, 1983, from the Quaternary of the British Isles, but differs in the shape of the alar expansion and in having a more elongate AM outline. No satisfactory views of the hinge were obtained, but the MS show the typical curved row of five adductors.

Distribution

Bythocythere sp. 3349 is confined to three sites in the extreme south of the survey area: TBD 6824 (90 m) and TBD 6847 (94 m), west of the Cape Peninsula, and TBD 1690 (172 m), south-west of Danger Point.

Family **Paradoxostomatidae** Brady & Norman, 1889

Genus *Paradoxostoma* Fischer, 1855

This genus is well represented in coastal sites around south-western Africa, with 13 species recorded between the Walvis Bay area (Swakopmund) and Knysna (Table 2) (Klie 1940; Hartmann 1974; McKenzie 1972). The disproportionately high concentration

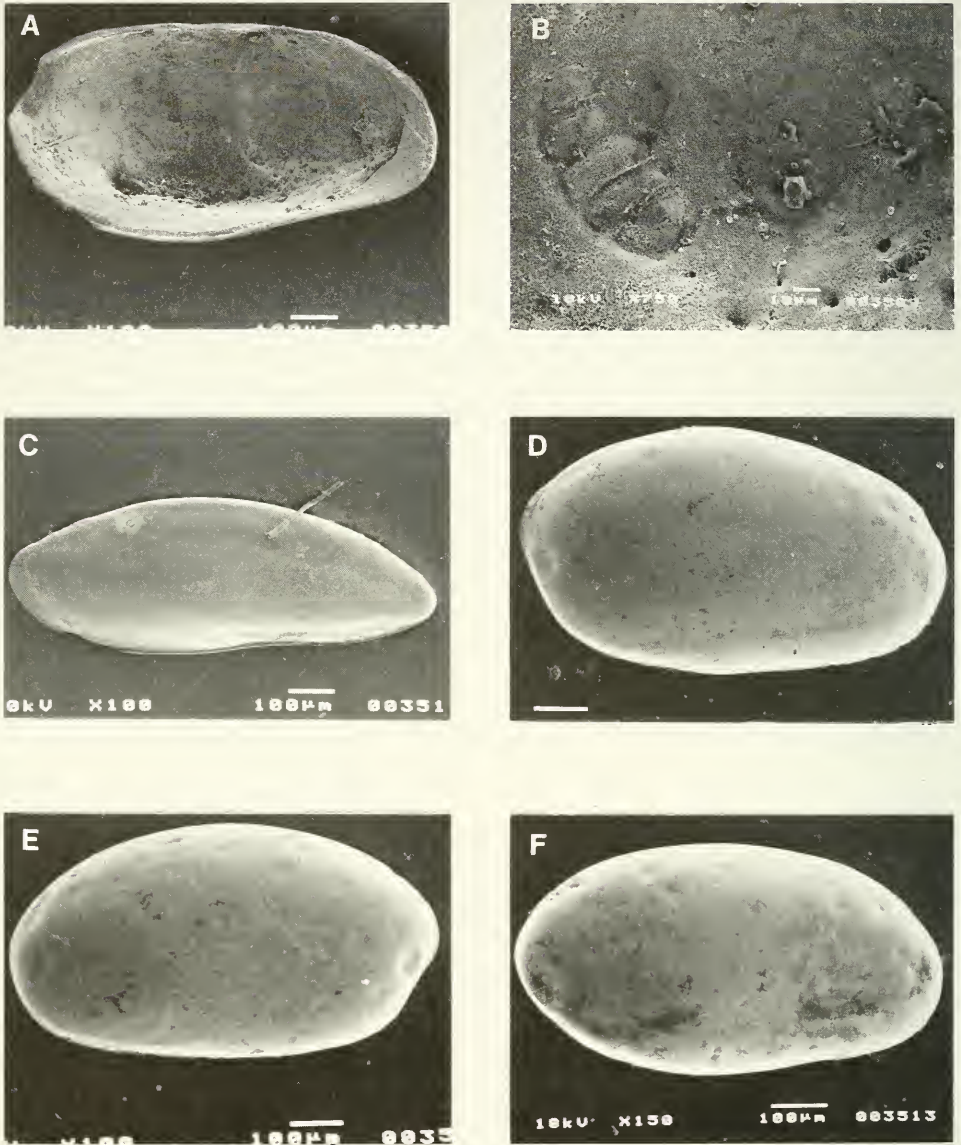


Fig. 15. A–B. *Bythocythere* sp. 3349, MF-0740, LV, TBD 6824, 90 m, internal views. A. SEM 3508. B. MS, SEM 3509. C. *Paradoxostoma* aff. *P. hederitzensis* Hartmann, 1974, MF-0698, LV, TBD 6846, 95 m, SEM 3511. D–E. *Paradoxostoma griseum* Klie, 1940, TBD 6821, 15 m. D. MF-0700, LV, SEM 3514. E. MF-0701, RV, SEM 3517. F. *Paradoxostoma* aff. *P. auritum* Klie, 1940, RV, TBD 6821, 15 m, SEM 3513. Scales: A. C–F = 100 μ ; B = 10 μ .

TABLE 2
Distribution of *Paradoxostoma* species around south-western Africa.

	WALVIS BAY	LÜDERITZ	CAPE PENINSULA	KNYSNA
<i>Paradoxostoma weberi</i> Hartmann	*			
<i>Paradoxostoma auritum</i> Klie		*		*
<i>Paradoxostoma</i> aff. <i>auritum</i> [#]			*	
<i>Paradoxostoma griseum</i> Klie [#]		*	*	
<i>Paradoxostoma reflexum</i> Klie		*		
<i>Paradoxostoma fluctusbenguelensis</i> Hartmann		*		
<i>Paradoxostoma phaeophycicola</i> Hartmann		*		
<i>Paradoxostoma luederitzensis</i> Hartmann		*		
<i>Paradoxostoma</i> aff. <i>luederitzensis</i> [#]			*	
<i>Paradoxostoma caeruleum</i> Klie		*		
<i>Paradoxostoma angustissimum</i> Klie		*		
<i>Paradoxostoma semilunae</i> Klie		*		
<i>Paradoxostoma kensleyi</i> McKenzie			*	

[#]—this paper

of records around Lüderitz probably reflects the greater amount of attention paid to the coastal fauna in this area. From the continental shelf, I have recorded the genus only off the Cape Peninsula (Fig. 16).

Paradoxostoma aff. *P. luederitzensis* Hartmann, 1974

Figs 15C, 17A

Paradoxostoma luederitzensis Hartmann, 1974: 340, pl. 121 (figs 848–849).

Illustrated material

	length	height
MF-0698, LV, TBD 6846, 95 m	0,90	0,35

Material

Sixteen valves.

Remarks

My material differs from Hartmann's topotypes in having a slightly different PM outline (being more broadly rounded and slightly upturned) and in the course followed by the inner margin. In my specimens, there is a prominently narrow sector, with an antero-adjacent bulge at about one-third length. In Hartmann's species the vestibule

widens progressively towards the anterior. They probably represent two different but closely related species.

Distribution

Hartmann (1974) recorded *P. luederitzensis* only from inshore localities at Lüderitz. In my study, this rare species (16 valves) was recovered from three sites to the west of the Cape Peninsula (Fig. 16), where both modern and relict specimens occur over the depth range 90–95 m.

Paradoxostoma aff. *P. auritum* Klie, 1940

Figs 15F, 17B

Paradoxostoma auritum Klie, 1940: 443–444, text-figs 82–85. Hartmann, 1974: 337, pl. 117 (figs 823–824).

Illustrated material

	length	height
MF-0699, RV, TBD 6821, 15 m	0,72	0,40

Material

23 valves.

Remarks

My material agrees well in valve outline and MS pattern with that illustrated by both Klie (1940) and Hartmann (1974), but the poor quality of preservation and sparsity of adults precluded a comparison of the marginal areas.

Distribution

Klie (1940) and Hartmann (1974) recovered *P. auritum* from coastal sites at Lüderitz and Knysna (outer entrance to the lagoon). In my study, this rare species (23 valves) occurred at three sites west of the Cape Peninsula, one of which (TBD 6821) lay in Hout Bay (Fig. 16).

Modern specimens occur at two sites, with a depth range 15–42 m, and a relict population of mostly poorly preserved material was found at one site (90 m).

Paradoxostoma griseum Klie, 1940

Fig. 15D–E

Paradoxostoma griseum Klie, 1940: 441–442, text-figs 75–77. Hartmann, 1974: 337–338.

Illustrated material

	length	height
MF-0700, LV, TBD 6821, 15 m	0,76	0,41
MF-0701, RV, TBD 6821, 15 m	0,72	0,44

Material

Four valves.

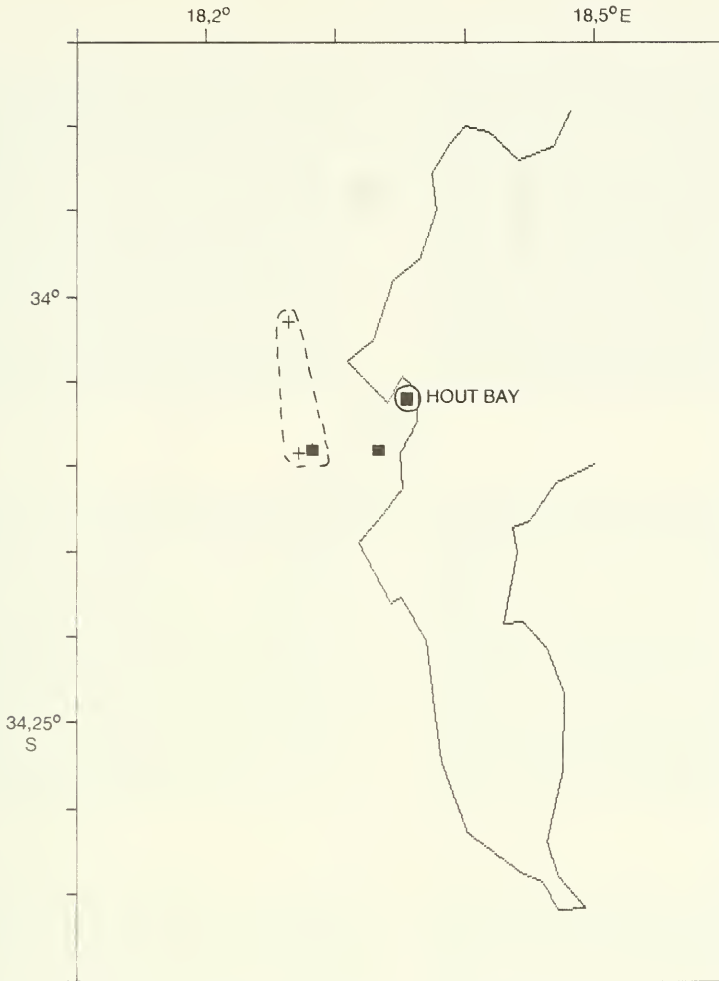


Fig. 16. Distribution of species of *Paradoxostoma* on the continental shelf off the Cape Peninsula. ■ = *Paradoxostoma* aff. *P. auritum* Klie, 1940; crosses and dashed line = *Paradoxostoma* aff. *P. luederitzensis* Hartmann, 1974; ○ = *P. griseum* Klie, 1940.

Remarks

SEM photographs of this rounded and distinctively shaped species are presented for the first time.

Distribution

Klie (1940) and Hartmann (1974) had previously recovered this species from several coastal sites: Lüderitz, Langebaan Lagoon, and Kommetjie (mid-way down the western side of the Cape Peninsula). I found it only at one site, in Hout Bay (15 m, 4 modern valves), suggesting that it is restricted to the coastal zone, and does not inhabit the continental shelf.

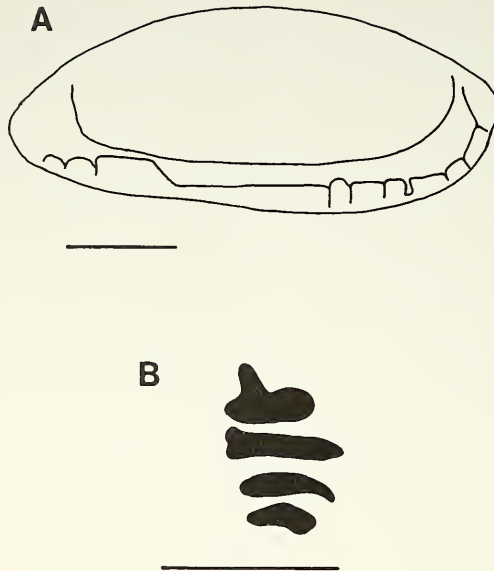


Fig. 17. A. *Paradoxostoma* cf. *P. luederitzensis* Hartmann, 1974, MF-0698, LV, TBD 6846, 95 m, internal view, marginal areas. B. *Paradoxostoma* cf. *P. auritum* Klie, 1940, MF-0797, LV, TBD 6821, 15 m, internal view; MS. Scales: 100 μ .

Genus *Cytherois* Müller, 1884

?*Cytherois* sp. 3538

Fig. 18A

Illustrated material

	length	height
MF-0748, LV, TBD 6824, 90 m	0,73	0,26

Material

Seven valves.

Remarks

None of the specimens available had complete inner lamellae; nor could the MS be seen clearly. This is a distinctive, elongate, cylindrical species with rounded AM and PM, with a slight dorsal deflection of the AM.

Distribution

This species was recovered as modern valves from three sites off the western Cape Peninsula, with a depth range of 90–95 m.

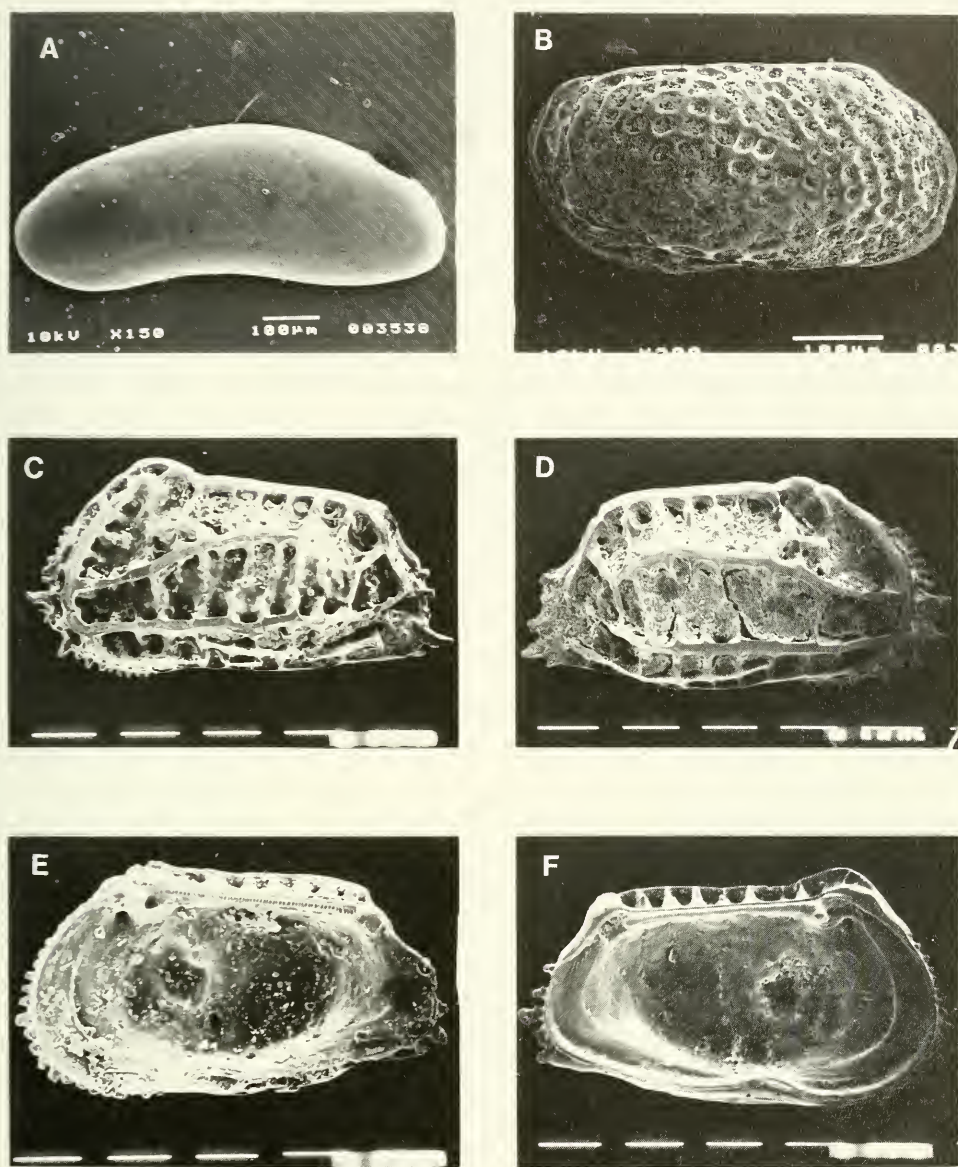


Fig. 18. A. *?Cytherois* sp. 3538, MF-0748, LV, TBD 6824, 90 m, SEM 3538. B. *?Kuiperiana* sp. 3320, MF-0713, RV, TBD 3089, 18 m, SEM 3320. C-F. *Chrysocythere craticula* (Brady, 1880). C. MF-0604, LV, TBD 270, 131 m, SEM 2359. D. MF-0605, RV, TBD 6823, 120 m, SEM 2376. E. MF-0606, RV, TBD 2973, 173 m, internal view, SEM 2365. F. MF-0607, LV, TBD 2472, 201 m, internal view, SEM 2361. Scales: all 100 μ .

Family **Loxoconchidae** Sars, 1925Genus *Kuiperiana* Bassiouni, 1962*?Kuiperiana* sp. 3320

Fig. 18B

Illustrated material

	length	height
MF-0713, RV, TBD 3089, 18 m	0,46	0,22

Material

Two valves.

Remarks

This species is most similar to *Kuiperiana angulata* Dingle, 1992, but differs in being more elongate and having a less-angular alation.

Distribution

A very rare species, found only at two sites: in St Helena Bay (TBD 3089: 18 m) and on the inner shelf mid-way between Lüderitz and Walvis Bay (TBD 3219: 75 m).

Family **Trachyleberididae** Sylvester-Bradley, 1948

Subfamily Trachyleberidinae Sylvester-Bradley, 1948

Genus *Chrysocythere* Ruggieri, 1962

This genus has been widely reported in Tertiary to Recent sediments from southern and western Africa (Fig. 19).

The earliest records are from the Eocene of the Agulhas Bank (possibly as old as Upper Palaeocene), where Frewin (1987) noted *C. craticula* and *Chrysocythere* sp. A096, and off Natal (*Chrysocythere* sp. as *?Costa* cf. *C. dahomeyi* (Apostolescu, 1961)—Dingle 1976). It is possible that Apostolescu's (1961) species *Anticythereis dahomeyi* from the Lower Eocene of Dahomey and Togo belongs in *Chrysocythere*. Van den Bold (1966) recorded three species from the Lower Miocene to Lower Pliocene of Gabon, including the type from the Upper Miocene of Sicily and southern Italy: *C. cataphracta* Ruggieri, 1962; *C. hexastriata* van den Bold, 1966; and *C. foveostriata* (Brady, 1870).

At least six species are extant on the continental shelves off western Africa: *C. craticula* (Brady, 1880) from southern Africa; *C. ornata* Hartmann, 1974, from Angola to the Congo estuary; and *Chrysocythere* sp. 13536 Rosenfeld & Bein, 1978, *C. asterospinosus* (Omatsola, 1969), *C. boldi* and *Chrysocythere* aff. *C. boldi* (Omatsola, 1972), and *C. iyemojai* (Omatsola, 1972) from west and north-west Africa.

Chrysocythere craticula (Brady, 1880)

Fig. 18C-F

Cythere craticula Brady, 1880: 89, pl. 21 (figs 7a-d). Puri & Hulings, 1976: 271, pl. 14 (figs 9-12).

Costa craticula (Brady) Keeler, 1981: 159-162, pl. 9 (figs 10-13).

Cativella sp. Boomer, 1985: 28-29, pl. 2 (figs 22-23).

Chrysocythere sp. A105 Frewin, 1987: 71-72, pls 23C, 24C-D. text-fig. 2.19C.

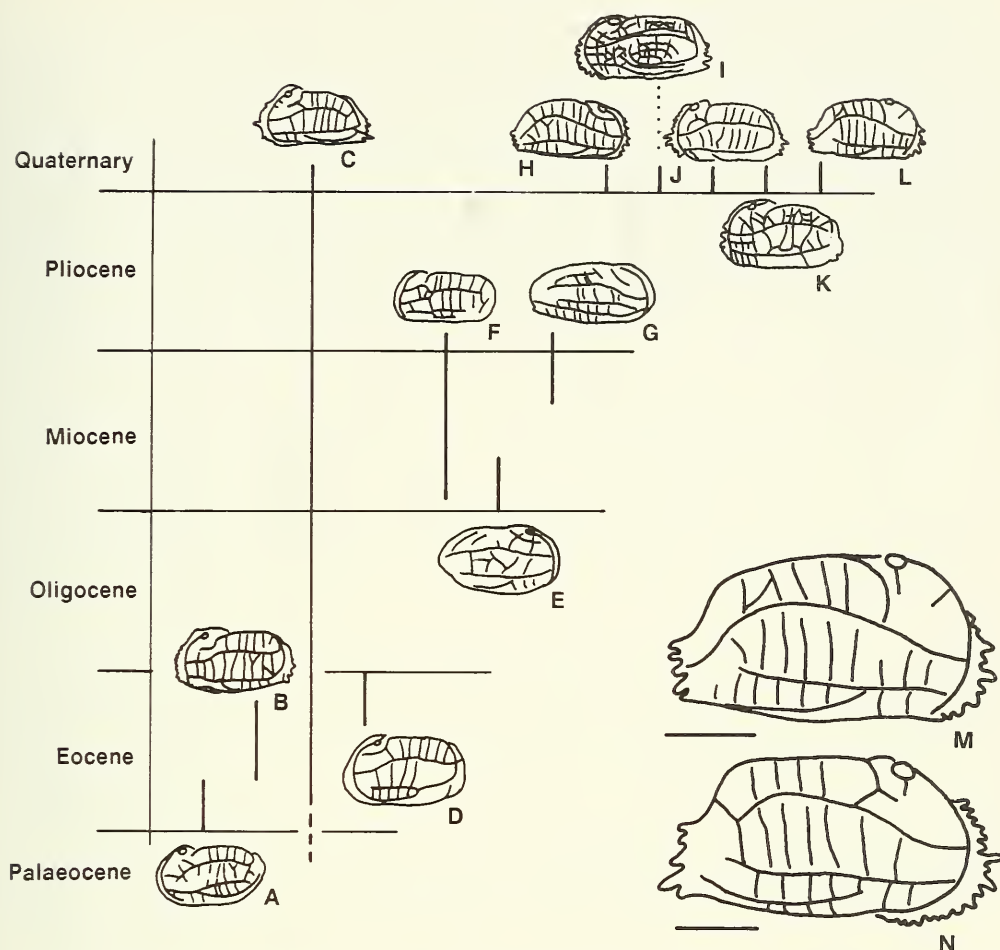


Fig. 19. Stratigraphic distribution of the genus *Chrysocythere* in west and south-western Africa, based on references cited in the text. A. ?*Chrysocythere dahomeyi* (Apostolescu, 1961). B. *Chrysocythere* sp. A096 Frewin, 1987. C. *C. craticula* (Brady, 1880). D. *Chrysocythere* sp. (Dingle, 1976). E. *C. hexastriata* van den Bold, 1966. F. *C. cataphracta* Ruggieri, 1962. G. *C. foveostriata* (Brady, 1870). H. *C. ornata* Hartmann, 1974. I. *Chrysocythere* sp. 13536 Rosenfeld & Bein, 1978. J. *C. asterospinosus* (Omatsola, 1969). K. *Chrysocythere* aff. *C. boldi* (Omatsola, 1972). L. *C. iyemojai* (Omatsola, 1972). M-N. Comparison of the ornamentation of two species. M. *C. iyemojai* (Omatsola, 1972), holotype, western Niger delta. N. *C. craticula* (Brady, 1880), MF-0605, TBD 6823, 120 m. Scales: 100 μ .

Illustrated material

	length	height
MF-604, LV, TBD 270, 131 m	0,68	0,36
MF-605, RV, TBD 6823, 120 m	0,74	0,39
MF-606, RV, TBD 2973, 173 m	0,69	0,36
MF-607, LV, TBD 2472, 201 m	0,73	0,40

Material

366 valves.

Remarks

The pattern of lateral ribs on this distinctive species is similar to that of the type species *C. cataphracta* Ruggieri, 1962 (e.g. see Sylvester-Bradley & Ruggieri 1973) but, overall, the valve outline of *C. craticula* is squatter and the posteroventral area more drawn out. Hartmann's (1974) species *C. ornata* can be distinguished from *C. craticula* by the former's more strongly curved median and dorsal ribs, which impart a gibbous aspect in lateral view, particularly in the RV (see also Babinot & Kouyoumontzakis 1986, pl. 3 (figs 1-2)).

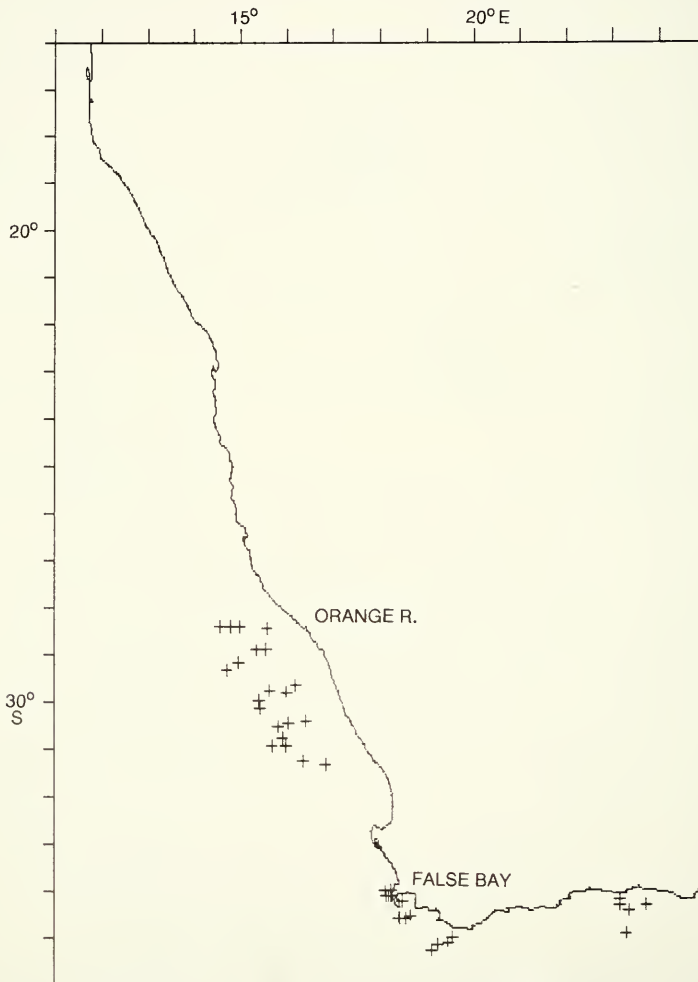


Fig. 20. Distribution of *Chrysocythere craticula* (Brady, 1880) on the continental shelf off south-western Africa.

Chrysocythere iyemojai (Omatsola, 1972), from Recent inshore areas off the Ivory Coast, is the closest species to *C. craticula*. The two species can be distinguished by differences in details of surface rib patterns. For example, the course of the dorsolateral rib at its anterior end, and the posterior end of the median rib (see Fig. 19).

Frewin (1987) recorded *Chrysocythere craticula* (as *Chrysocythere* sp. A105) from two Palaeogene sea-floor samples from the Agulhas Bank, and there are no significant morphological differences between her ?Palaeocene–Eocene specimens and my Quaternary material. A second Eocene species noted by Frewin (1987: *Chrysocythere* sp. A096) from the same area has an outline more similar (but not identical) to *C. ornata* Hartmann.

Distribution

Brady (1880) recorded this species from 'Challenger' station 140 at 15–20 fms (27–37 m) in False Bay. My data show that it occurs as far north as 28°S (just north of the Orange River) and extends on to the eastern Agulhas Bank (Keeler 1981) (Fig. 20).

Modern specimens occur at two sites only, both in the vicinity of the Cape Peninsula (TBD 5254: 40 m in False Bay; and TBD 6823: 120 m south-west of Cape Town).

Relict faunas on the Orange–Namaqualand shelf (28–31,5°S) occur between 135 m and 300 m water depth, whereas in the south (Cape Peninsula to Agulhas Bank) the UDL is 40 m (False Bay) and the LDL 220 m.

Genus *Neocaudites* Puri, 1960

Species of this genus have been widely reported from both coasts of North America, and Omatsola (1972) has recorded two species from the Niger Delta area. Although there are no records from the intervening shelf region between west and southern Africa, the genus is well represented, albeit in small numbers, in south-western Africa south of the Kunene River (17°S).

Three new Quaternary species have been recognized in the present study (*Neocaudites osseus*, *N. lordi*, and *N. punctatus*), and Frewin (1987) described a further new species from the Upper Eocene of the Agulhas Bank (recorded as *Parvacypthereis* sp. A053).

Neocaudites lordi sp. nov.

Figs 21A–F, 22A, G

?*Neocythereis* sp. Boomer, 1985, text-fig. 5.

Derivation of name

This species is named for Prof. A. R. Lord (University College London), in acknowledgement of his assistance during my studies on south-west African ostracods.

Holotype

	length	height
MF-608, C, TBD 2257, 100 m	0,78	0,46

Paratypes

	length	height
MF-609, C, TBD 6823, 120 m	1,00	0,50
MF-610, LV, TBD 2257, 100 m	0,80	0,46
MF-611, RV, TBD 2257, 100 m	0,80	0,42

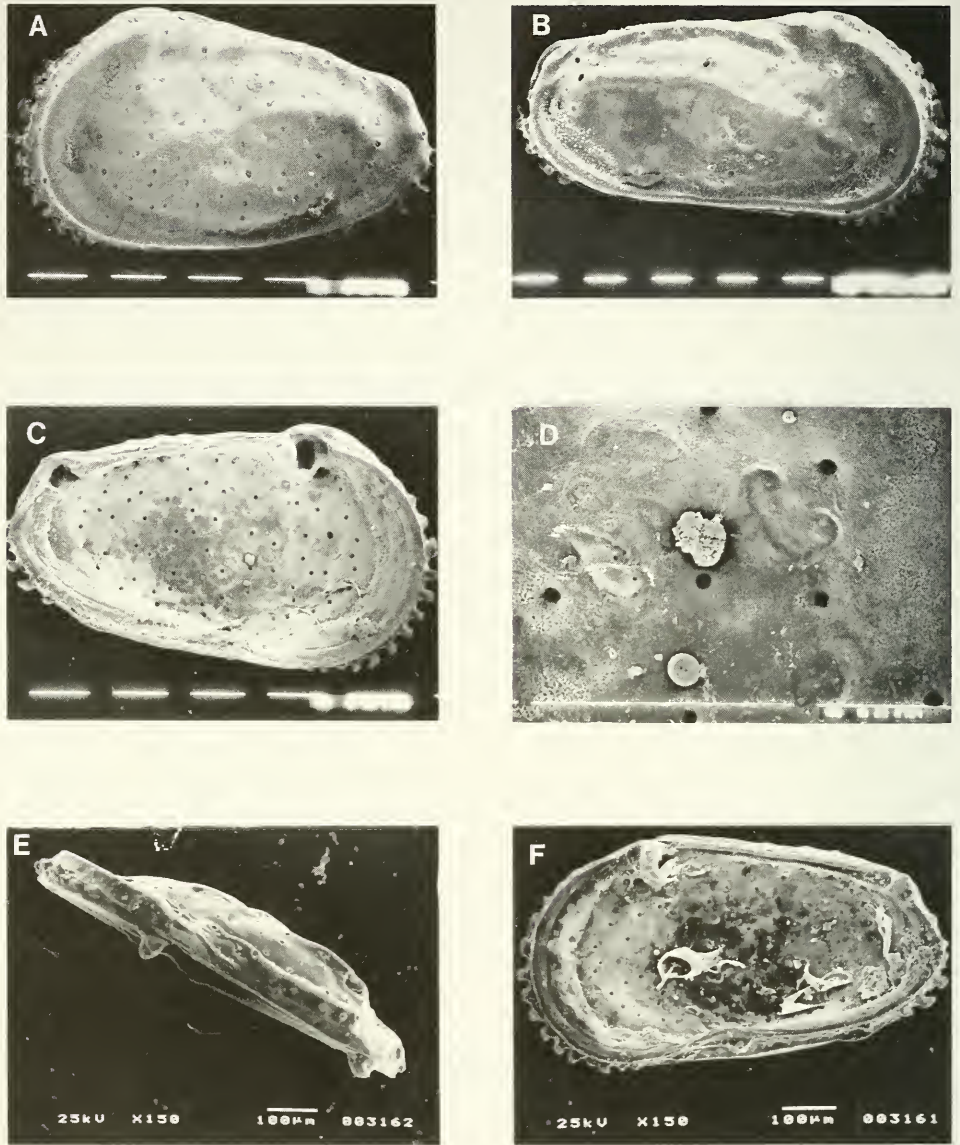


Fig. 21. A–F. *Neocaudites lordi* sp. nov. A. MF-0608, holotype, C, TBD 2257, 100 m, SEM 2748. B. MF-0609, paratype, C, TBD 6823, 120 m, SEM 2751. C–D. MF-0610, TBD 2257, 100 m. C. Internal view, SEM 2752. D. MS, SEM 2754. E–F. MF-0611, TBD 2257, 100 m. E. Dorsal view, SEM 3162. F. Internal view, SEM 3161. Scales: all 100 μ .

Material

32 valves.

Diagnosis

Relatively large, plump species of *Neocaudites* with a prominent post-ocular depression, an entire AM to PM ridge, and a diffuse ventral longitudinal rib.

Description

External features. Relatively large, heavily calcified valves, with an overall plump aspect. AM broadly rounded, PM narrowly rounded, asymmetrically so in the LV, both

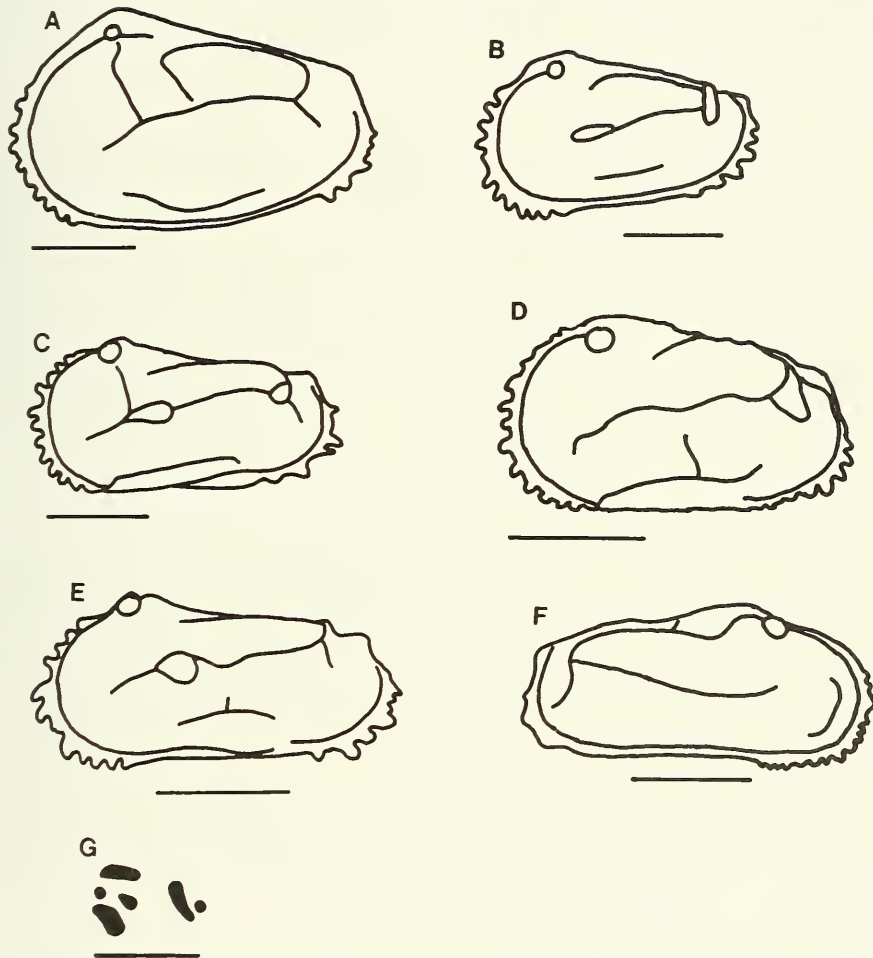


Fig. 22. A-F. Sketch outlines of various species of *Neocaudites*. A. *N. lordi* sp. nov., holotype, LV, MF-0608, TBD 2257, 100 m. B. *N. osseus* sp. nov., holotype, LV, MF-0612, TBD 6836, 80 m. C. *N. punctatus* sp. nov., holotype, LV, TBD 5890, 115 m. D. *N. triplistriatus* (Edwards, 1944) (from Hazel 1977, fig. 7d). E. *Neocaudites* sp. A3260 (Frewin, 1987, pl. 29A). F. *N. terryi* Holden, 1967, holotype, USNM 648756 (fig. 33a). G. MS of *N. lordi* sp. nov., MF-0610, TBD 2257, 100 m. Scales: A-F = 200 μ ; G = 100 μ .

margins strongly denticulate. DM straight, VM slightly convex: they converge somewhat posteriorly. Surface ornamentation consists of an entire, broad AM to PM ridge, which commences at the weak eye spot. There is a low DM rib that broadly recurves at the PCA into a diagonal longitudinal rib. The connection between these two ribs is low and weak. The diagonal rib crosses a low weak SCT, and is joined by two weak curved elevations to the eye spot and the anterior end of the DM rib. Between these two sub-vertical ridges there is a low but prominent post-ocular depression. A short, weak, diffuse rib in a median position lies close to the VM. Overall the valve surface is smooth, with numerous prominent NPC openings.

Internal features. MA moderately wide, with numerous straight MPC. The hinge is holamphidont, with a stepped RV ATE. The PTA is squared. There is a large ocular sinus. The MS consist of a hook-shaped anterior scar and four adductors, the middle two being round and small.

Remarks

This is the largest and least prominently sculptured of the four local species of the genus (Fig. 22). Its closest relative is the contemporaneous *N. osseus* sp. nov., but the two can be distinguished by the difference in size and the plumper aspect and more diffuse ornamentation of *N. lordi*. Other details include the weak loop that joins the diagonal and DM longitudinal ribs and possession of a post-ocular depression. The weakness in ornamentation is similar to that of *N. terryi* Holden, 1967, from the Neogene of the Hawaiian Islands, but the latter species is overall compressed and considerably smaller (holotype is 550 μ in length).

Distribution

Neocaudites lordi is relatively widespread (19,7°–34°S—Fig. 23A) and locally relatively abundant, particularly north of Lüderitz (3%).

Modern valves were recovered over the whole latitudinal range and most of the depth range of the species: 100–295 m. Off the south-western Cape, the modern sites are also the shallowest (100–120 m), whereas farther north modern valves were recovered from 184 m to 295 m.

Off the south-western Cape, the relict fauna of this species occurs at depth ranges of 100–160 m, whereas farther north it occurs at 169–379 m. The deeper locations north of Lüderitz are also those at which *N. lordi* attains relatively high abundances.

Neocaudites osseus sp. nov.

Figs 22B, 24A–D

Munseyella sp. Keeler, 1981: 158–159, pl. 9 (figs 8–9).

Occultocythereis sp. 2 Boomer, 1985: 30–31, pl. 2 (fig. 32).

Derivation of name

Osseus—Latin, bony; fanciful reference to emaciated aspect of valve surface.

Holotype

	length	height
MF-0612, C, TBD 6836, 80 m	0,62	0,35



Fig. 23. Distribution of *Neocaudites* species on the continental margin off south-western Africa. A. *N. lordi* sp. nov. Dashed lines enclose modern sites. B. *N. osseus* sp. nov. (crosses, modern sites inside dashed line), and *N. punctatus* sp. nov. (diamonds, north of 24°S).

Paratypes

	length	height
MF-0613, C, TBD 6836, 80 m	0,61	0,37
MF-0614, RV, TBD 6823, 120 m	0,56	0,31
MF-0615, LV, TBD 270, 131 m	0,62	0,37

Material

142 valves.

Diagnosis

Small species of *Neocaudites* with a large eye spot, short prominent surface ribs, and a prominent, almost bullate posterodorsal process.

Description

External features. Small valves with prominent ribbing which gives an emaciated, bony appearance from which the species name is derived. AM broadly rounded, PM narrowly rounded, both margins are strongly denticulate, with prominent quadrate processes. DM and VM almost straight, converging strongly posteriorly. Ornamentation consists of an entire AM to PM rib, which commences as a small but round, prominent eye spot. There is a short but prominent DM rib that recurves to a short diagonal rib at

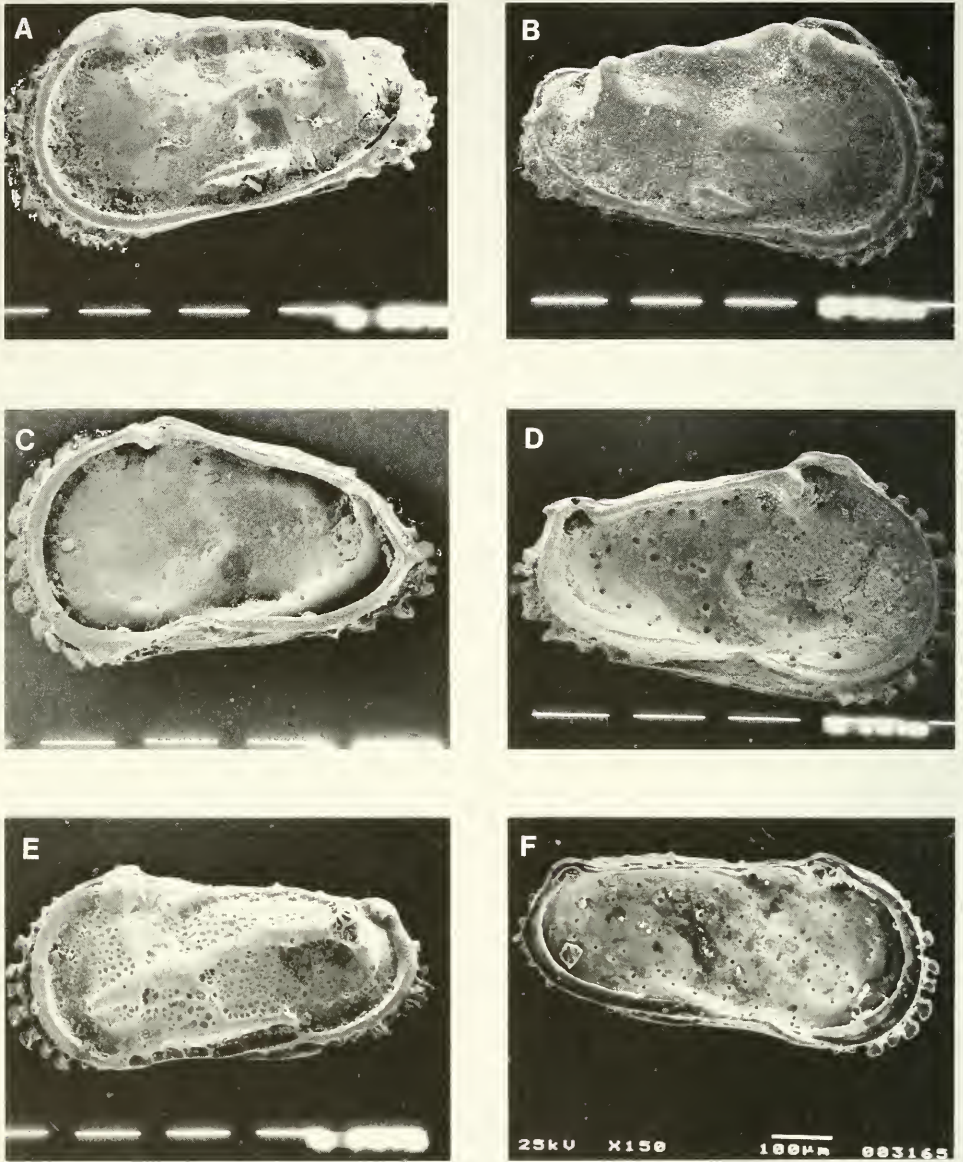


Fig. 24. A–D. *Neocaudites osseus* sp. nov. A. MF-0612, holotype, C, TBD 6836, 80 m, SEM 2776. B. MF-0613, paratype, C, TBD 6836, 80 m, SEM 2779. C. MF-0614, paratype, RV, TBD 6823, 120 m, SEM 2780. D. MF-0615, paratype, LV, TBD 270, 131 m, SEM 2783. E–F. *Neocaudites punctatus* sp. nov., MF-0616, holotype, LV, TBD 3890, 115 m. E. External view, SEM 2785. F. Internal view, SEM 3165. Scales: all 100 μ .

the PCA; here the loop is strongly elevated, almost bullate. The diagonal rib extends a short distance anteriorly beyond the weak SCT. There is a very short, prominent ventrolateral rib. Overall the valve surface is smooth, except for occasional pustules with NPC openings.

Internal features. The RV has a quasi-triangular outline in internal view. MA of moderate width, with numerous straight simple MPC. MS not seen clearly. Hinge holamphidont.

Remarks

Although *N. osseus* sp. nov. is similar in general architecture to *N. lordi* sp. nov., there are numerous points of difference (see Remarks for *N. lordi* and Fig. 22). In detail, *N. osseus* is closest to *Neocaudites* sp. A3260 Frewin, 1987, from the local Eocene. The main differences are the much thicker marginal rim of the Eocene taxon (which is not entire—there is a posteroventral break) and its inverted 'T'-shaped ventrolateral rib. The closeness of morphology and similarity of geographical distribution strongly suggests that *N. osseus* is descended from *Neocaudites* sp. A3260. Both these species bear considerable similarity in overall rib disposition to the local Quaternary species *N. punctatus* sp. nov., from the northern part of the west-coast margin, and *N. triplistriatus* (Edwards, 1944), which has a range Pliocene–Pleistocene in south-eastern USA (e.g. Cronin & Hazel 1979). However, the latter two species are both punctate, and have a prominent dorsal deflection of the VM ridge at about mid-length.

Neocaudites sp. Holden, 1976, from the Lower Miocene of Midway Island (Pacific Ocean), has a similarly stark rib pattern to *N. osseus* but differs in possessing a relatively long ventrolateral rib, which is linked by a short rib to the SCT, where there is a star-shaped disposition of ribs.

Distribution

Neocaudites osseus sp. nov. is confined to the area south of the Orange River (29,7°S to 34,6°S) (Fig. 23B) and is most abundant off the south-western Cape. Keeler (1981) recorded four valves from the eastern Agulhas Bank.

Modern specimens are restricted to areas off the south-western Cape (off Saldanha and the Cape Peninsula), where they are found only at the shallowest sites, with UDL and LDL of 58 m and 120 m, respectively.

Relict populations range northwards to the southern Orange shelf, and have a total depth range of 58–201 m.

Neocaudites punctatus sp. nov.

Figs 22C, 24E–F, 25A–C

Derivation of name

Puncta—Latin, punctuation; reference to punctate ornamentation.

Holotype

	length	height
MF-0616, LV, TBD 3890, 115 m	0,62	0,30

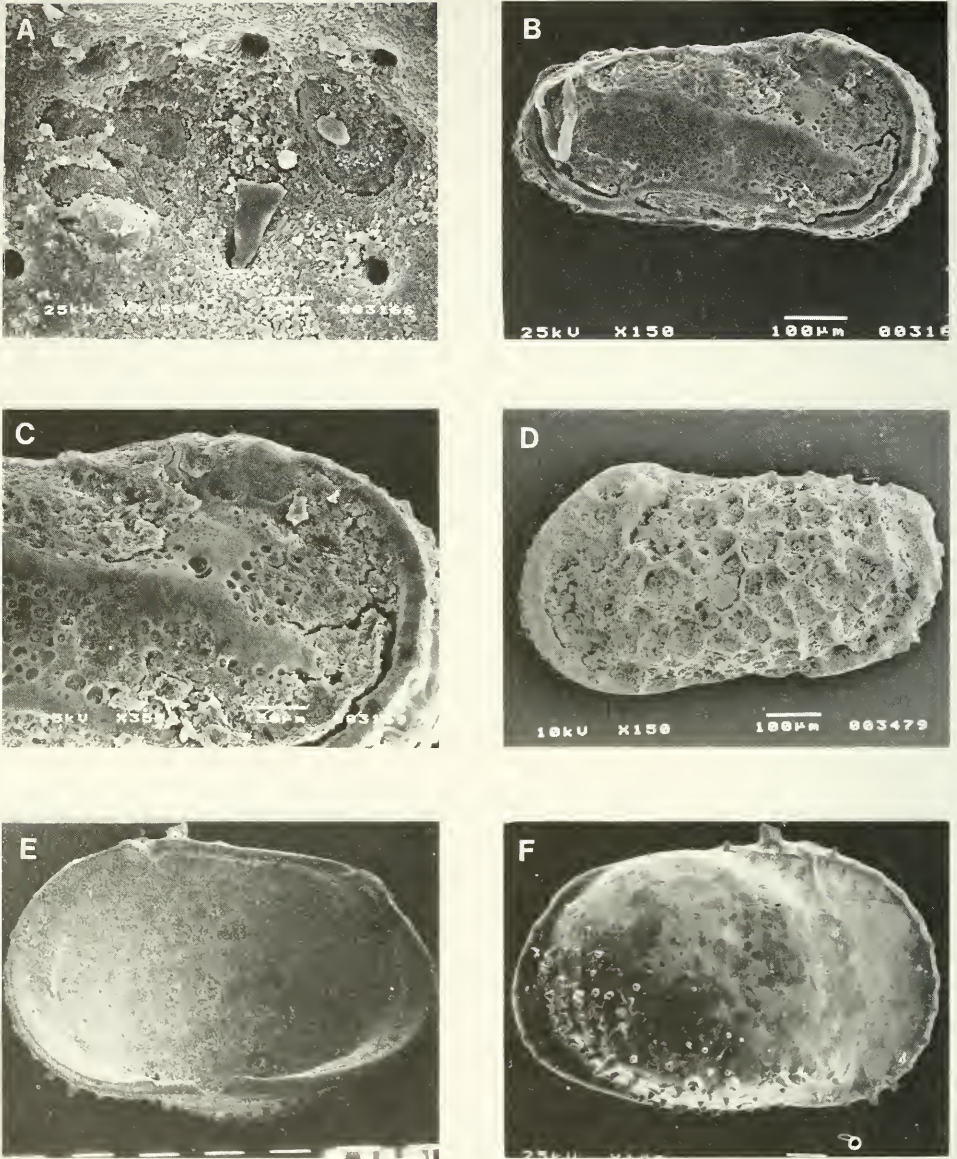


Fig. 25. A-C. *Neocaudites punctatus* sp. nov. A. MF-0616, holotype, LV, TBD 3890, 115 m, MS, SEM 3166. B-C. MF-0617, paratype. C, TBD 3359, 385 m. B. SEM 3167. C. Detail of anterodorsal area, SEM 3169. D. *Stigmatocythere* sp. 3479, MF-0769, RV, TBD 2260, 303 m, SEM 3479. E-F. *Bathyocythere vanstraatemi* Sissingh, 1971, MF-0618, TBD 3109, 900 m. E. Internal view, SEM 3061. F. External view, SEM 3171. Scales: A = 10 μ ; B, D-F = 100 μ ; C = 50 μ .

Paratype

	length	height
MF-0617, C, TBD 3359, 385 m	0,66	0,31

Material

Three valves.

Diagnosis

A punctate species of *Neocaudites*, with a ventrolateral longitudinal rib that is joined to the AM rib.

Description

External features. Elongate in lateral view with broadly rounded AM that has large quadrate denticles. PM more narrowly rounded, also with prominent processes that are more spinose than on the AM. DM and VM almost straight, converging only slightly posteriorly. Surface ornamented with several prominent ribs. A thick AM rib commences at a large rounded eye spot and ends at the anteroventral corner, where it connects to a prominent ventrolateral rib that extends to about two-thirds valve length. The PM has a thick prominent rib that commences at a posterodorsal node and ends at about mid-length on the VM. The DM rib is thin and is joined to the thick prominent median diagonal rib via a posterior retroflexion. The median rib crosses the SCT and extends almost to the AM. The SCT is linked by a series of small riblets to the eye spot, the anterior end of the DM rib, and the ventrolateral rib. Intercostal areas are finely reticulate or punctate.

No clear internal views were visible (see Fig. 24F).

Remarks

The closest previously described species to *Neocaudites punctatus* is *N. triplistriatus* (Edwards, 1944) from the Plio-Pleistocene of south-eastern USA. Both are punctate/reticulate, and have a ventrolateral longitudinal rib that is linked to the marginal ribs. However, they differ in that *N. triplistriatus* has a prominent anterodorsally directed riblet on the ventrolateral rib, a feature that is lacking in *N. punctatus* (see SEM illustrations in Hazel 1977, fig. 7D; Cronin & Hazel 1979, fig. 8G). This inverted 'T' is a characteristic of the smooth-surfaced *Neocaudites* sp. A053 Frewin, 1987.

None of the local species of *Neocaudites* can be confused with *N. punctatus*, because of its punctate ornamentation and details of the lateral rib patterns.

Distribution

The distribution of this rare species is limited to the northern part of the survey area, with one site off Walvis Bay (162 m), and the other just south of the Kunene River (115 m) (Fig. 23B). No modern specimens were found.

Summary of the distribution of Neocaudites on the continental margin

Modern populations of *Neocaudites* are restricted to the south-western Cape (*N. osseus* and *N. lordi*), and the area between the Walvis Ridge abutment and just north of Lüderitz (*N. lordi*).

Relict faunas are more widespread and fall into three well-defined categories: *N. punctatus* is confined to areas north of Walvis Bay; *N. osseus* is a southern species

that is most abundant off the south-western Cape, but extends as far north as 30°S and eastward to 24°E; and *N. lordi* occurs over the whole of the central west-coast margin, but is absent from the extreme north and south, and is most abundant between the Walvis Ridge abutment and Lüderitz.

Genus *Stigmatocythere* Siddiqui, 1971

Stigmatocythere sp. 3479

Fig. 25D

Stigmatocythere cf. *S. obliqua* Siddiqui, 1971. Dingle, 1976: 47, fig. 11 (28).

Stigmatocythere sp. A141 Frewin, 1987: 91–93, pls 34A–D, 35A–F, text-fig. 2.22.

Illustrated material

	length	height
MF-0769, LV, TBD 2260, 303 m	0,77	0,41

Material

Two valves. A further five valves are possibly juveniles of this species.

Remarks

This species has been recorded by Dingle (1976) and Frewin (1987) from Eocene strata on the continental shelf off Natal, and the Agulhas Bank, respectively. Although my material is relict, the state of preservation and matrix do not suggest that it has been reworked from Tertiary strata. Consequently, it is a strong possibility that this species was extant on the local continental shelf until early Holocene times.

Stigmatocythere sp. 3479 is very similar to the type *S. obliqua* Siddiqui, 1971, from the Eocene of Pakistan, and to *S. bornhardti* Ahmad, Neale & Siddiqui, 1991, from the Miocene of Tanzania. It differs from both in details of ornamentation.

Distribution

This rare species was recovered from two sites (TBD 2260: 303 m; and TBD 2861: 165 m) on the northern and southern ends of the Orange–Namaqualand shelf, respectively. Two further sites (TBD 270: 131 m; and TBD 3587: 140 m) off the south-western Cape yielded possible juveniles.

Genus *Bathycythere* Sissingh, 1971

Bathycythere vanstraateni Sissingh, 1971

Fig. 25E–F

'*Xandarosina*' Benson & Sylvester-Bradley, 1971: 76, fig. 6 (3A–B). Boomer, 1985, pl. 3 (fig. 50).

Bathycythere vanstraateni Sissingh, 1971: 410, pls 1–2, text-figs 2–4; 1974: 133–140. Bremen, 1975: 213, pl. 4 (fig. 20).

Illustrated material

	length	height
MF-0618, RV, TBD 3109, 900 m	1,17	0,75

Material

One valve.

Remarks

The single specimen recovered during the survey is a juvenile, which accounts for the lack of stout sharp spines that are characteristic of adults of the species.

Distribution

Although this species is found in Plio–Pleistocene sediments from the Indian Ocean to the Mediterranean (Bremen 1975), it was recorded at one site only off south-western Africa (TBD 3109, north-west of Cape Columbine), at 900 m on the upper continental slope.

Genus *Trachyleberis* Brady, 1898

Trachyleberis sp. 3586

Fig. 26A

Illustrated material

	length	height *
MF-0793, RV, TBD 3359, 385 m	1,10	0,60

Material

One valve.

Remarks

This large, somewhat squat species carries numerous lance-like spines, the most prominent of which lies at the anterodorsal corner.

Distribution

This very rare species was recovered from one site only (TBD 3359: 385 m), on the outer continental shelf west of Lüderitz.

Subfamily Thaerocytherinae Hazel, 1967

Genus *Bradleya* Hornibrook, 1952

Bradleya cf. *B. dictyon* (Brady, 1880)

Fig. 26B–C

Cythere dictyon Brady, 1880: 99, pl. 24 (figs 1 h–i, l, o–p, s–u (*non* a–g, j–k, m–n, q–r, v–y). Puri & Hulings, 1976: 273–274, pl. 16 (figs 6–8), text-fig. 6.

Bradleya dictyon (Brady) Benson, 1972: 34–38, pl. 9 (figs 1–12), pl. 11 (fig. 18), text-figs 13B, 15–17; 1978: pl. 1 (fig. 4). Ducasse & Peypouquet, 1979, pl. 3 (fig. 9). Whatley *et al.*, 1984: 274–275, pl. 1 (figs 1–3).

* excluding spines

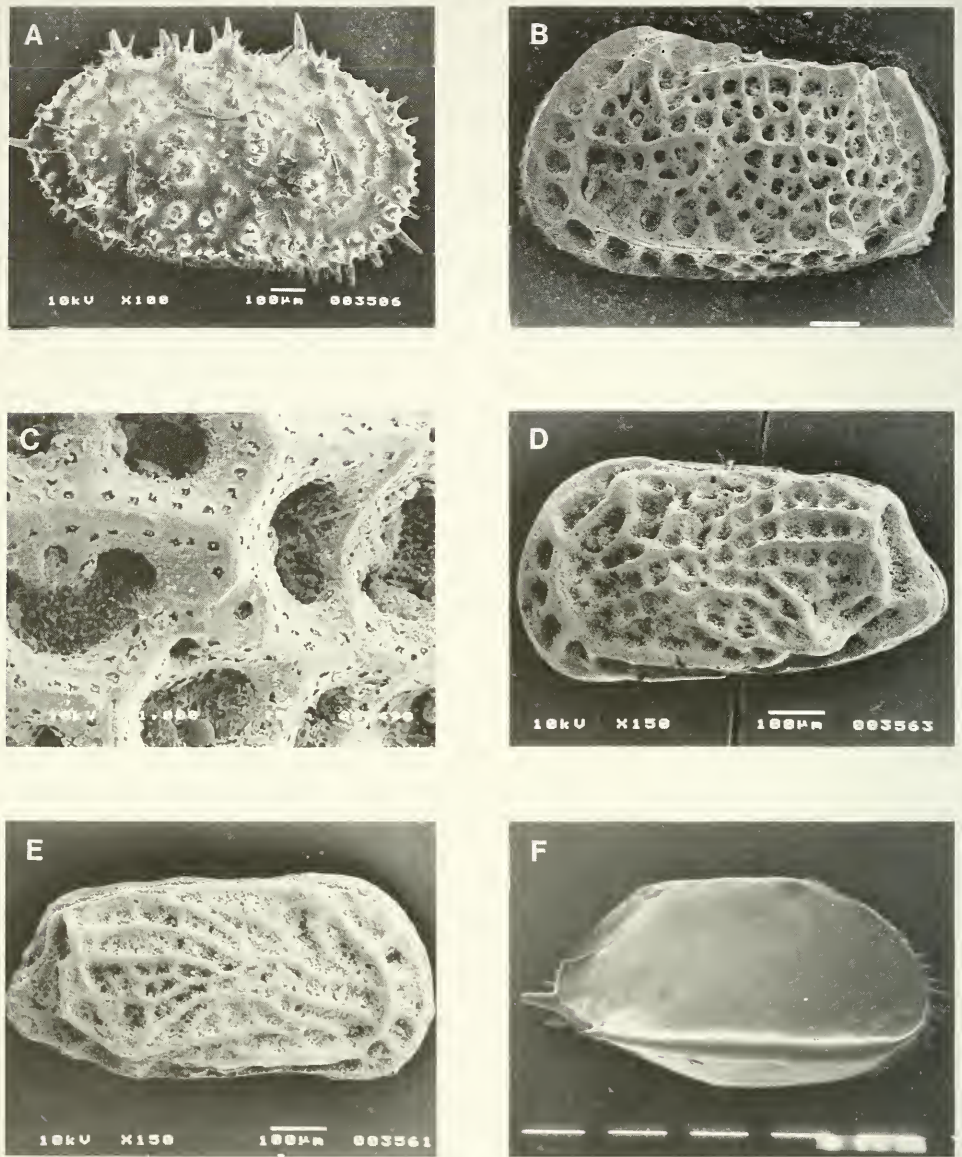


Fig. 26. A. *Trachyleberis* sp. 3586. MF-0793, RV, TBD 3359, 385 m, SEM 3586. B-C. *Bradleya* cf. *B. dieryon* (Brady, 1880), MF-0774, LV, TBD 1698, 502 m. B. SEM 3488. C. Detail of ornamentation in medio-posterior region. SEM 3490. D-E. *Bradleya* (?*Quasibradleya*) sp. 3563, C, TBD 2840, 205 m. D. MF-0782, left view, SEM 3563. E. MF-0781, right view, SEM 3561. F. *Incongruellina venusta* sp. nov., MF-0619, holotype. RV, TBD 3943, 373 m, SEM 3036. Scales: A-B, D-F = 100 μ ; C = 10 μ .

Illustrated material

	length	height
MF-0774, LV, TBD 1698, 502 m	0,85	0,50

Material

One valve.

Remarks

This specimen is identical to those illustrated by Benson (1972) from the Mozambique Channel and Whatley *et al.* (1984) from the south-western Pacific, with the exception that the muri of its ornamentation are slightly thicker. It displays the delicate foveolation that Benson recorded (1972, pl. 9 (figs 8–9)). Previous authors (e.g. Benson 1972; Whatley *et al.* 1984; Whatley 1985) have considered *B. dictyon* to be predominantly an abyssal taxon, but bathyal populations are known in Oligocene to Quaternary sediments from eastern Australia. Whatley *et al.* (1984) accounted for this by postulating that it was in this area that the species originated as a shallow-water taxon.

Benson (1972) found the species in the nearby Mozambique Channel at 2 005 m, and the present record from 502 m would appear to be the shallowest so far, outside the south-western Pacific. Curiously, the species does not occur in deeper waters off the south-western Cape (Dingle *et al.* 1990), although Peypouquet & Benson (1980) found *Bradleya* spp. below 2 000 m off Walvis Bay and in the Angola Basin.

Bradleya antarctica Hartmann, 1989, from the vicinity of the Antarctic Peninsula, has a coarser reticulation and denser foveolation. This species also inhabits relatively shallow-water environments (184–233 m) (Hartmann 1989).

Distribution

This very rare species was recorded relict at one site only (TBD 1698: 502 m), on the upper continental slope south of Cape Point.

Subgenus *Bradleya* (*Quasibradleya*) Benson, 1972*Bradleya* (?*Quasibradleya*) sp. 3563

Fig. 26D–E

Bradleya sp. Boomer, 1985, pl. 4 (fig. 57).

Illustrated material

	length	height
MF-0781, C, TBD 2840, 205 m	0,76	0,36
MF-0782, C, TBD 2840, 205 m	0,73	0,39

Material

Eight valves.

Remarks

I suspect that all four carapaces of this species, which were collected from one sample, are re-worked from older strata, but cannot substantiate this. Also, I hesitate to

assign this species to *B. (Quasibradleya)*, because it has a more prominent arrangement of longitudinal median ribs than in previously described species. However, the essential features of the *Bradleya* morphology occur, and the upper rib of the bridge is strengthened and continues over the MS node into a longitudinal median ridge, as diagnosed for the genus *Quasibradleya*.

Distribution

This rare species occurs at one site only (TBD 2840: 205 m), on the mid-Orange–Namaqualand shelf.

Genus *Poseidonamicus* Benson, 1972

Two species of this genus occur off south-western Africa: *P. major* Benson, 1972, is a cosmopolitan abyssal taxon that is confined below *c.* 2 000 m within the North Atlantic Deep Water (Dingle *et al.* 1989, 1990; Dingle & Lord 1990); and *P. panopsus* Whatley & Dingle, 1989, which occurs on the continental shelf and slope to depths of *c.* 500 m.

Poseidonamicus panopsus Whatley & Dingle, 1989

Fig. 31A–B

Bradleya? sp. Boomer, 1985: 42–43, pl. 3 (figs 35–36).

Poseidonamicus panopsus Whatley & Dingle, 1989: 442–447, figs 2, 3, 4A–E, 5C.

Illustrated material

	length	height
MF-0503, LV, TBD 2719, 240 m	0.89	0.52
MF-0506, C, TBD 2840, 205 m	0.85	0.47

Material

119 valves.

Distribution

Poseidonamicus panopsus occurs in three widely separated locations on the west-coast continental margin: a single valve north-west of Walvis Bay (22,25°S: 223 m); numerous sites on the Orange–Namaqualand shelf; and a small cluster west and south of the Cape Peninsula (Fig. 27).

Modern valves are restricted to two sites on the Orange–Namaqualand shelf, with a depth range of 205–241 m.

The UDL of relict populations is 120 m, but the maximum LDL is either 545 m (off the Cape Peninsula), or 350 m on the Orange–Namaqualand shelf, depending on the degree of allochthonism in the two areas (Whatley & Dingle 1989).

Subfamily Pterygocytherinae Puri, 1957

Genus *Incongruellina* Ruggieri, 1958

Three species of this genus have been recorded from the south-eastern Atlantic Ocean, two of which are from Tertiary strata: *Incongruellina* sp. A500 Frewin, 1987,

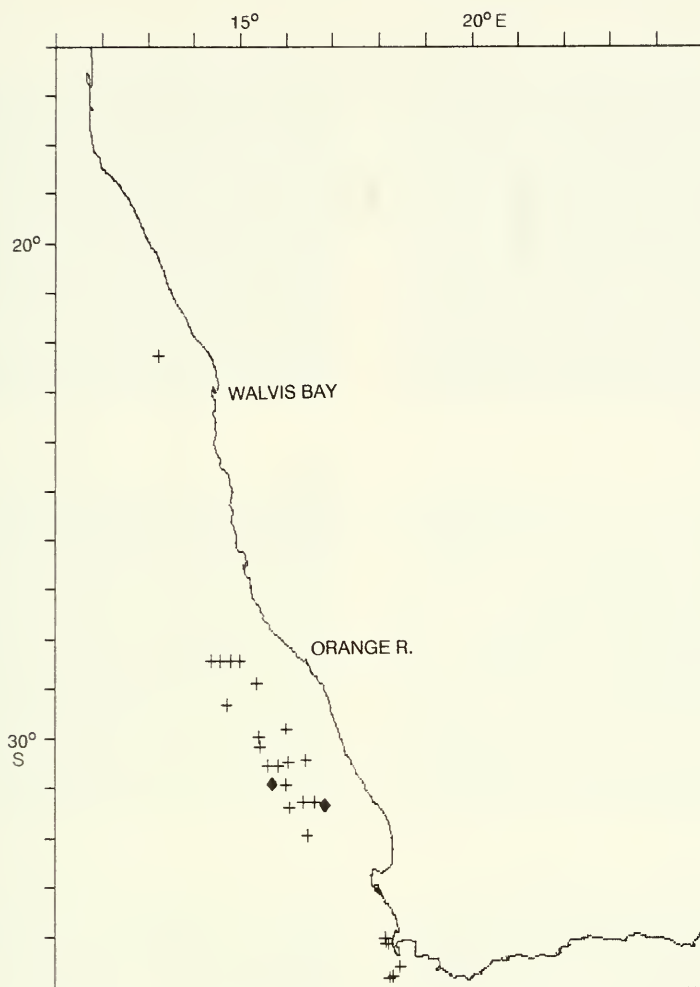


Fig. 27. Distribution of *Poseidonamicus panopsus* Whatley & Dingle, 1989, on the continental margin off south-western Africa. Modern sites indicated by black diamonds.

Eocene, Agulhas Bank; *Incongruellina marginatostriata* (Seguenza) (Van den Bold 1966), Mio-Pliocene, Gabon; and *Incongruellina venusta* sp. nov., Quaternary, south-western African offshore.

Two other Eocene species were also referred to *Incongruellina* by Frewin (1987), but their taxonomic status is uncertain.

***Incongruellina venusta* sp. nov.**

Figs 26F, 28A–F, 29

Incongruellina cf. *I. semispinescens* Ruggieri, 1958. Boomer, 1985: 21–23, pl. 2 (figs 24–26).

Derivation of name

Venustus—Latin, graceful; reference to its graceful outline.

Holotype

	length	height
MF-0619, RV, TBD 3943. 373 m	0,70	0,38

Paratypes

	length	height	width
MF-0620, LV, TBD 3523, 295 m	0,61	0,46	
MF-0621, RV, TBD 3577, 453 m	0,64	0,37	
MF-0622, LV, TBD 3577, 453 m	0,60	0,40	
MF-0623, C, TBD 3523, 295 m	0,70		0,55
MF-0624, RV, TBD 3577, 453 m	0,70	0,46	

Material

93 valves.

Diagnosis

Species of *Incongruellina* with a rounded DM in LV and small anterior vestibules.

Description

External features. LV and RV differ considerably in lateral outline. In both valves, AM is broadly and asymmetrically rounded and spinose. In LV, the DM is rounded, with an weak rim, PM is caudate, and the VM is hidden by a broadly rounded ala that has a thick, curved rim. In RV, the DM is short and straight, with distinct anterior and posterior cardinal angles, the PM is caudate, and the VM is convex, partly obscured by the ala that has a thick, almost straight rim. Both valves carry a sharp spine on the PM at the line of greatest length, but that on the RV is usually larger and both have a posteriorly directed spine at the trailing tip of the ala. There is a small prominent eye spot and ocular sinus. The valve surface is smooth.

Internal features. MA are moderately wide. Vestibules are small, V-shaped and lie in the anteroventral corner with eight long, thin RPC dorsally. Hinge amphidont, relatively short and robust. RV ATE has a massive base, surmounted by a sharp tooth, PTE is a thick, rectangular tooth. The ME is coarsely crenulate. MS consist of a lobate V-shaped anterior scar and four adductors, the dorsal-most is inclined at an angle to the others, which are smaller.

Remarks

Incongruellina venusta sp. nov. is very similar to the type species, *I. semispinescens* Ruggieri, 1958, from the Neogene of Italy. They differ in the strongly rounded LV DM of *I. venusta*, and in the significantly larger anterior vestibule of *I. semispinescens*, which has a larger PM spine.

The new species is probably closest to *Incongruellina* sp. A500 Frewin, 1987 (see pl. 1A–G), but the two have subtle differences in shape: the AM outline of *I. venusta* is more broadly rounded, and its LV DM significantly more rounded. In addition, the ala spine in Frewin's species is ventrally deflected, and its hinge is longer, less robust and apparently has a smooth ME.

Van den Bold (1966) allocated a species to *Bosquetina marginatostriata*? (Seguenza).

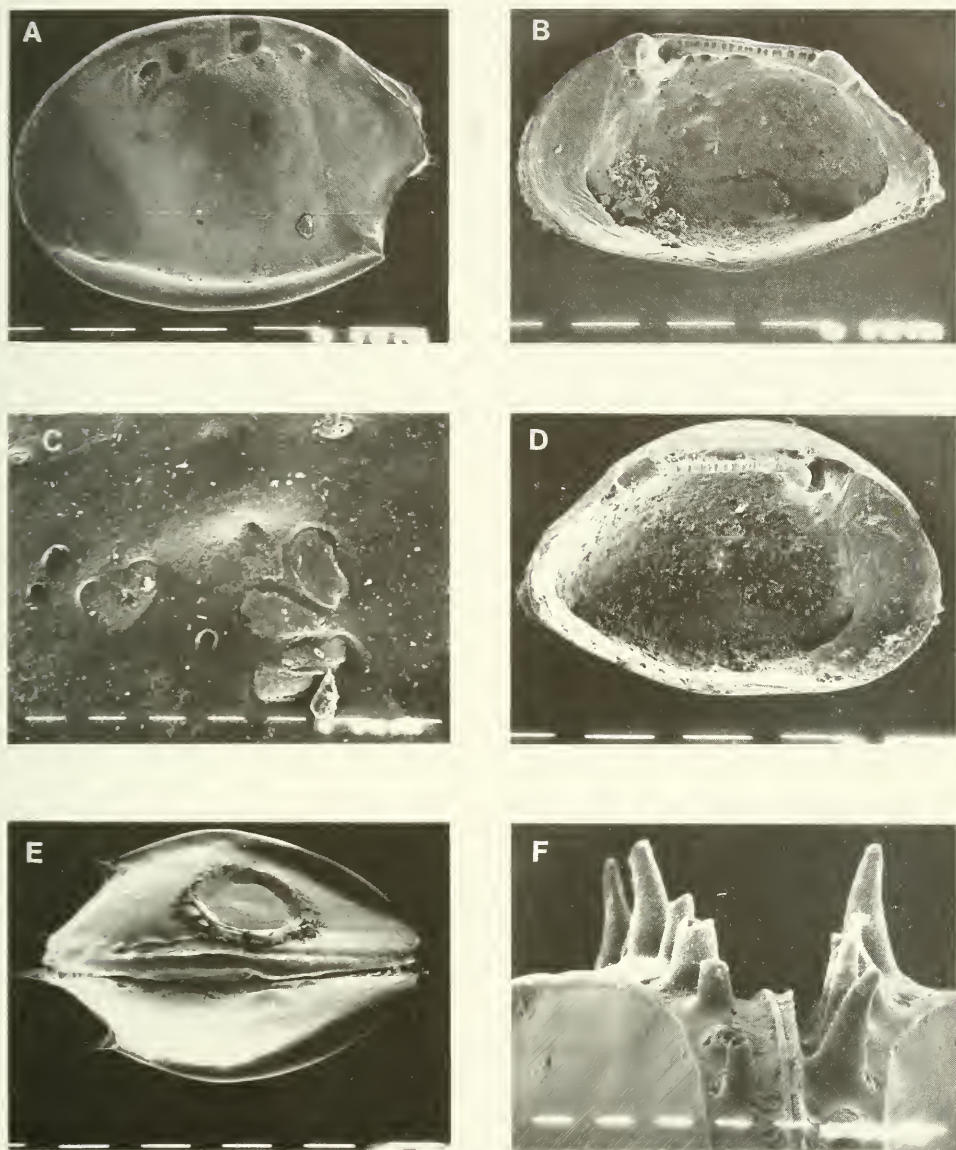


Fig. 28. A-F. *Incongruellina venusta* sp. nov., paratypes. A. MF-0620, LV, TBD 3523, SEM 2735. B-C. MF-0621, RV, TBD 3577, 453 m. B. Internal view, SEM 2733. C. MS, SEM 2725. D. MF-0622, LV, TBD 3577, 453 m, internal view, SEM 2728. E-F. MF-0623, C, TBD 3523, 295 m. E. Dorsal view, SEM 2719. F. Detail of anterodorsal area in dorsal view, SEM 2720. Scales: A-B, D-E = 100 μ ; C, F = 10 μ .

It is so similar in shape to the two southern Africa species of *Incongruella* that I suggest that it also belongs to this genus. The major difference between Van den Bold's species and *I. venusta* sp. nov. is the former's more acuminate PM outline.

Incongruella tonsa Ahmad, Neale & Siddiqui, 1991, from the Lower Miocene of Tanzania is a more elongate species that lacks a long posteroventral spine.

Distribution

Incongruella venusta sp. nov. is widely distributed in two main areas along the middle to outer shelf off the west coast. The largest area stretches from 19°S (Walvis Ridge abutment shelf) to 31,5°S (Namaqualand shelf), and it has been recorded from three sites between False Bay and Cape Agulhas (34,5°–35,5°S) (Fig. 30).

Modern specimens occur between Walvis Bay and the Walvis Ridge abutment, and at three sites off Namaqualand; they have a depth range of 150–453 m.

Relict populations are more extensive, and occur as far south as the Cape Peninsula. Their depth range is at least 131–453 m, with two bathymetrically isolated sites (TBD 3555: 590 m; and TBD 3458: 725 m) of uncertain status.

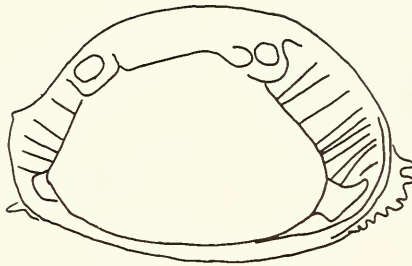


Fig. 29. *Incongruella venusta* sp. nov., MF-0624, paratype, LV, TBD 3577, 453 m, internal features. Scale = 100 μ .

Family **Krithidae** Mandelstam, 1960

Genus *Krithe* Brady, Crosskey & Robertson, 1874

Nine species of *Krithe* were recorded by Dingle *et al.* (1990) from the continental margin off south-western Africa. Four of these occur in water shallower than 950 m, although only one (*K. capensis* Dingle, Lord & Boomer, 1990) has a significant presence on the continental shelf.

The genus is well represented in the Upper Cretaceous and Tertiary of southern Africa (e.g. Dingle 1981, 1976; Frewin 1987), where at least five species have been differentiated. Van den Bold (1966) recorded two species from the Mio–Pliocene of Gabon.

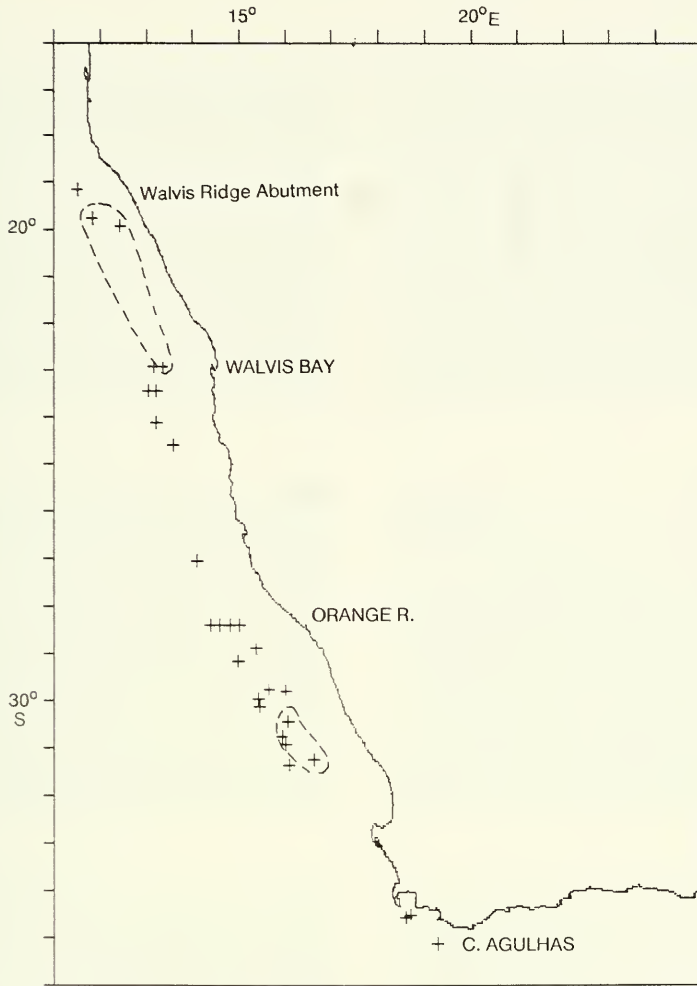


Fig. 30. Distribution of *Incongruellina venusta* sp. nov. on the continental margin off south-western Africa. Modern sites enclosed by dashed line.

Krithe capensis Dingle, Lord & Boomer, 1990

Fig. 31C–D

Krithe spp. Boomer, 1985: 57–58, pl. 4 (fig. 63).

Krithe capensis Dingle, Lord & Boomer, 1990: 269–272, figs 16A–C, 17A, 18D.

Illustrated material

	length	height
MF-0429, LV, TBD 2879, 530 m	0,91	0,50
MF-0430, RV, TBD 3577, 435 m	0,95	0,50

Material

144 valves.

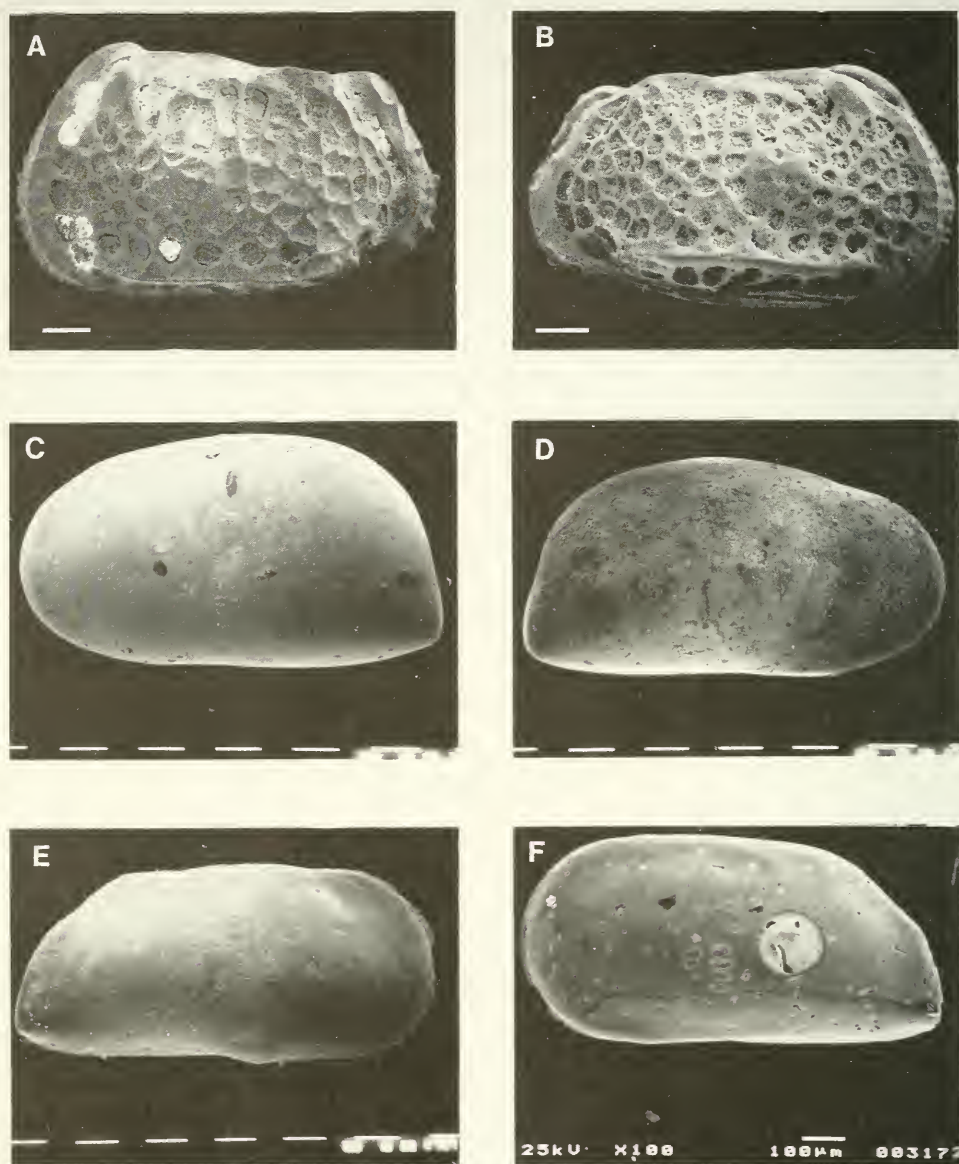


Fig. 31. A–B. *Poseidonamicus panopsus* Whatley & Dingle, 1989. A. MF-0503, LV, TBD 2719, 240 m, SEM 2872. B. MF-0506, C. TBD 2840, 205 m, SEM 2873. C–D. *Krithe capensis* Dingle, Lord & Boomer, 1990. C. MF-0429, holotype, LV, TBD 2879, 530 m, SEM 2708. D. MF-0430, RV, TBD 3577, 435 m, SEM 2714. E–F. *Krithe spatularis* Dingle, Lord & Boomer, 1990. E. MF-0433, RV, TBD 2978, 736 m, SEM 2704. F. MF-0625, LV, TBD 2879, 530 m, SEM 3172. Scales: all 100 μ .

Distribution

Krithe capensis has the shallowest UDL (238 m) and the greatest latitudinal range (17.6–35.4°S; 1 900 km) of the nine Quaternary species of *Krithe* recorded off south-western Africa (Figs 32A, 33A). It is the only species present on the middle shelf and, to water depths of *c.* 800 m (upper slope), *K. capensis* is the overwhelmingly dominant *Krithe* species. Its LDL is either 1 071 m or 1 430 m; Dingle *et al.* (1990) suspected that the latter is an allochthonous record.

The main populations of *K. capensis* occur in a continuous swathe along the outer shelf–upper slope between Lüderitz and south-west of Cape Agulhas. Two smaller centres lie off Walvis Bay and on the upper slope to the north of the Walvis Ridge.

Krithe spatularis Dingle, Lord & Boomer, 1990

Figs 31E–F, 34A

Krithe spatularis Dingle, Lord & Boomer, 1990: 272–276, figs 16D–F, 17B, 18E.

Illustrated material

	length	height
MF-0433, RV, TBD 2978, 736 m	1,02	0,50
MF-0625, LV, TBD 2879, 530 m	0,99	0,50

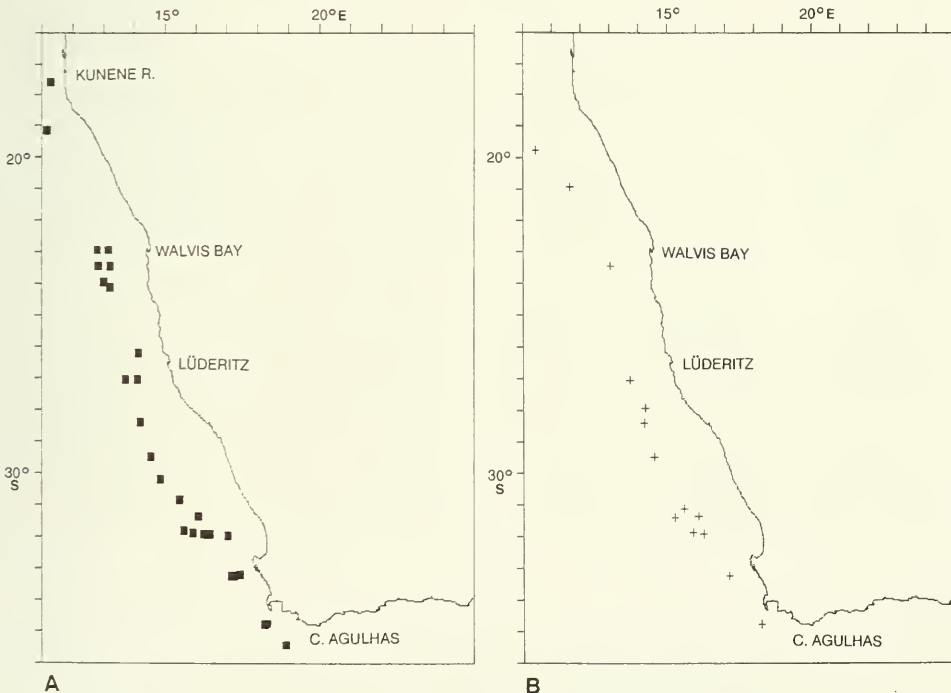


Fig. 32. Distribution of *Krithe capensis* Dingle, Lord & Boomer 1990 (A) and *Krithe spatularis* Dingle, Lord & Boomer, 1990 (B) on the continental margin off south-western Africa.

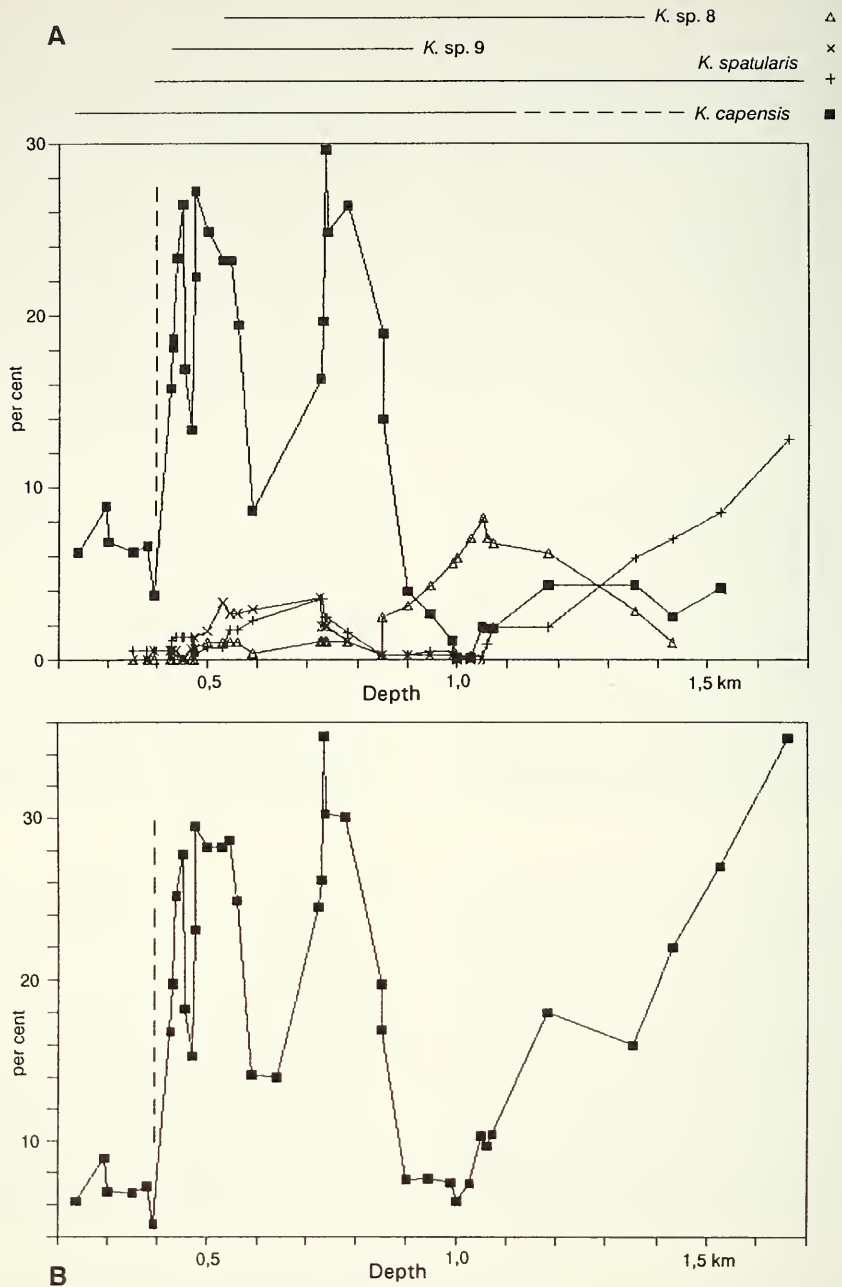


Fig. 33. A. Depth ranges (bars) of various species of *Krithe* that occur in water depths < 950 m. The graphs show percentage of total ostracod fauna of each species: \blacksquare = *K. capensis*; Δ = *Krithe* sp. 8. $+$ = *K. spatularis*. \times = *Krithe* sp. 9. Vertical dashed line represents the edge of the continental shelf (400 m). B. *Krithe* component as percentage of total ostracod fauna (below 1 km, this includes deep-water *Krithe* species).

Material

Twelve valves.

Distribution

The UDL and LDL of *Krithe spatularis* (392 m and 1 662 m) is the largest depth range of the four species of *Krithe* that occur in relatively shallow water (upper to middle continental slope—Fig. 33A). The species is found in sites scattered along the continental margin between 20°S and 35°S, but only south-west of Lüderitz and off Namaqualand do these cluster into extensive population centres (Fig. 32B).

Krithe spatularis is never an abundant species, and supplants *K. capensis* within the *Krithe* fauna only near the latter's LDL.

Krithe sp. 8 Dingle, Lord & Boomer, 1990

Fig. 34B–C

Krithe sp. 8 Dingle, Lord & Boomer, 1990: 281–282, figs 17C, 18C, 22B–C.

Illustrated material

	length	height
MF-0626, RV, TBD 2978, 736 m	1,00	0,48

Material

Eleven valves.

Distribution

Krithe sp. 8 is restricted to the upper continental slope (530–1 353 m, Fig. 33A), where it occurs at isolated sites between 20°S and 34°S (Fig. 35A). Although *Krithe* sp. 8 is generally subordinate to other species within the genus, it is the most abundant over a narrow depth 'window' at about 1 000 m, at the base of the Antarctic Intermediate Water salinity minimum zone.

Krithe sp. 9 Dingle, Lord & Boomer, 1990

Fig. 34D

Krithe sp. 9 Dingle, Lord & Boomer: 282, figs 17N, 18A, 23C.

Illustrated material

	length	height
MF-0627, RV, TBD 3524, 475 m	0,86	0,46

Material

Twelve valves.

Distribution

Krithe sp. 9 occurs at scattered sites along the continental margin between 23°S and 35°S, and has the most restricted geographic distribution of the four shelf–upper slope taxa of the genus (Fig. 35B). It also has the narrowest depth range (430–900 m—Fig. 33A).

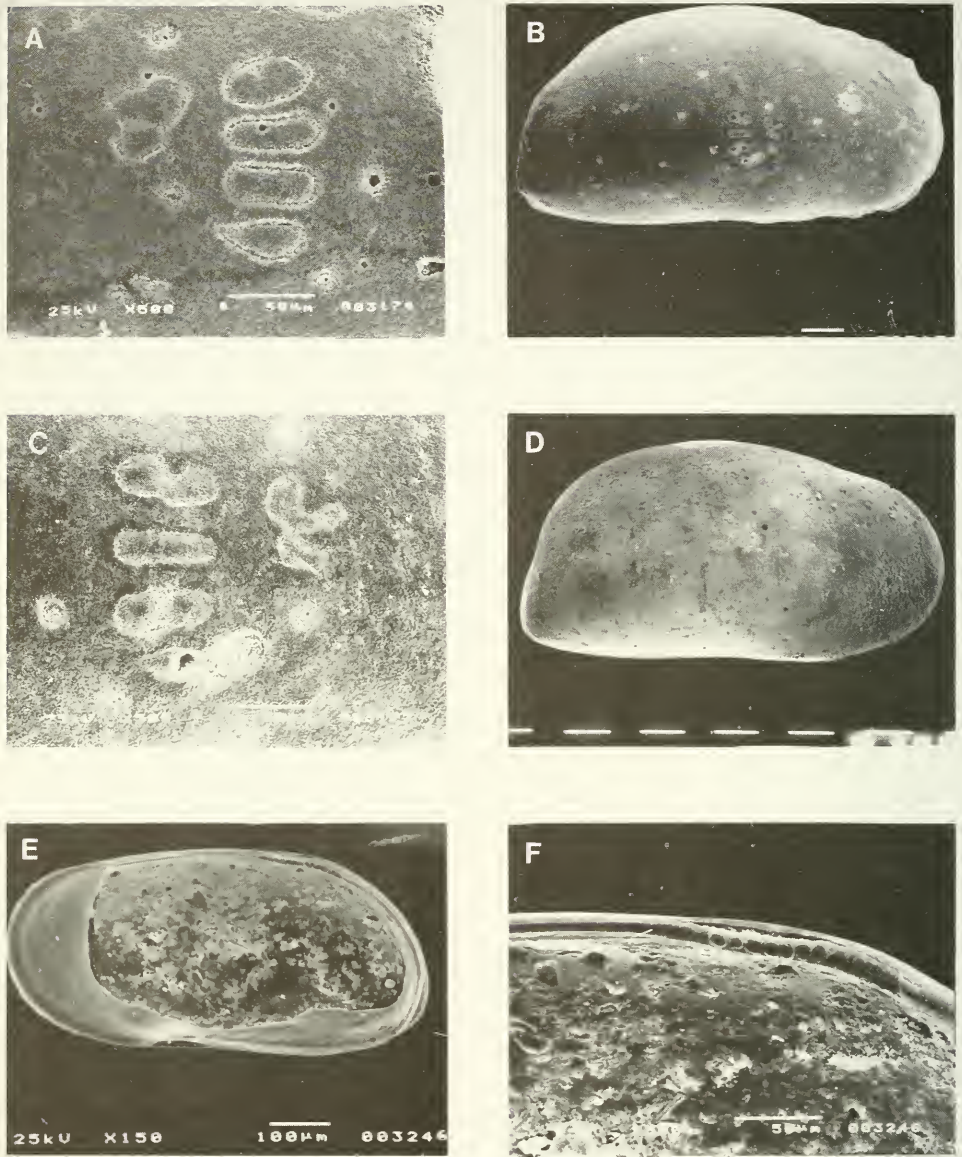


Fig. 34. A. *Krithe spatularis* Dingle, Lord & Boomer, 1990, LV, MF-0625, TBD 2879, 530 m, external view of MS, SEM 3174. B-C. *Krithe* sp. 8, MF-0626, RV, TBD 2978, 736 m. B. SEM 3176. C. External view of MS, SEM 3177. D. *Krithe* sp. 9, MF-0627, RV, TBD 3524, 475 m, SEM 2632/27. E-F. *ParakritHELLa simpsoni* sp. nov., holotype, MF-0696, RV, TBD 6846, 95 m. E. Internal view, SEM 3240. F. PTE, SEM 3248. Scales: A, C, F = 50 μ ; B, D, E = 100 μ .

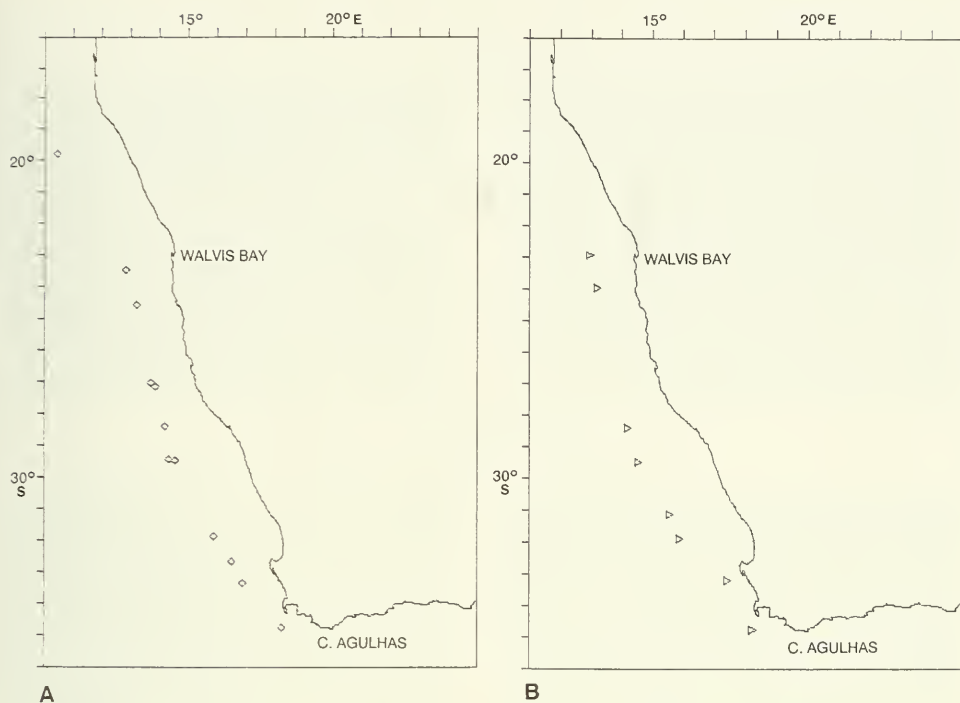


Fig. 35. Distribution of *Krithe* sp. 8 (A) and *Krithe* sp. 9 (B) on the continental margin off south-western Africa.

Distribution of the genus Krithe on the continental shelf and upper slope off south-western Africa

The four shallow-water taxa of *Krithe* are distributed in a narrow zone between Walvis Bay and south-west of Cape Agulhas, with a short zone, mid-way between Walvis Bay and Lüderitz, that is barren of all species. Farther north, there are isolated sites of all taxa except *Krithe* sp. 9.

There are large variations in the abundance of *Krithe* across the continental margin (Fig. 33B). On the shelf (<400 m), the genus is of minor importance but there is a rapid increase in abundance on the uppermost slope, where *Krithe* accounts for >20 per cent of the total ostracod fauna. The slope abundance peak is bimodal, with a major low at 600 m that coincides approximately with the upper limit of the Antarctic Intermediate Water (AAIW) salinity minimum zone. A further low occurs at the base of the AAIW salinity minimum zone (c. 950 m), which marks the faunal boundary between the bathyal (deep-water) and lower neritic (shallow-water) faunas. Below this level, deep-water species of *Krithe* rapidly increase in importance and the genus becomes the dominant taxon in the ostracod faunas.

The distribution of individual species changes in sympathy with alterations in overall abundance of *Krithe* at 950 m and 400 m (compare Fig. 33A, B). Above 950 m, the *Krithe* component of the ostracod fauna is dominated by *K. capensis*, with only minor representation by the three other species. On the shelf (<400 m) only *K. capensis* occurs but,

just below the shelf break, the major increase in *Krithe* abundance coincides with the downslope appearance (i.e. the UDL) of *K. spatularis*, *Krithe* sp. 9, and *Krithe* sp. 8. *Krithe* sp. 9 does not extend below the upper slope environment.

Below 950 m, the rapid decline of *K. capensis* is accompanied by the progressive increase in importance of *Krithe* sp. 8 (c. 1 000 m) and *K. spatularis* (c. 1 400 m). None of the four upper slope *Krithe* taxa extend far below 1 500 m, which is the Antarctic Intermediate Water/North Atlantic Deep Water boundary (Dingle *et al.* 1989, 1990).

Genus *Parakrithella* Hanai, 1961

This is the first record of the genus from southern Africa, although it has been widely reported from the Far East and Australia.

Parakrithella simpsoni sp. nov.

Figs 34E–F, 36A–F, 37A, 38

Derivation of name

This species is named for the late Professor E. S. W. Simpson (ex University of Cape Town), for his far-sighted contributions to the geological exploration of the sea-floor around southern Africa.

Holotype

	length	height
MF-0696, RV, TBD 6846, 95 m	0,70	0,34

Paratypes

	length	height
MF-0692, RV, TBD 6846, 95 m	0,66	0,33
MF-0693, C, TBD 6846, 95 m	0,66	0,32
MF-0694, LV, TBD 270, 131 m	0,75	0,35
MF-0695, C, TBD 6846, 95 m	0,76	0,35
MF-0697, RV, TBD 270, 131 m	0,69	0,33
MF-0798, LV, TBD 6823, 120 m	0,70	0,35

Material

67 valves.

Diagnosis

A small, elegant species of *Parakrithella* with parallel DM and VM, an asymmetrically rounded PM, and nine short simple AM RPC.

Description

External features. Overall shape is compact and elegant. Small elongate valves with markedly parallel, straight DM and VM. AM broadly rounded, with a slight anteroventral upswing, PM asymmetrically rounded with a slight angle at the PC corner. The posteroventral outline is rounded. In dorsal view, the carapace is almost parallel sided, with

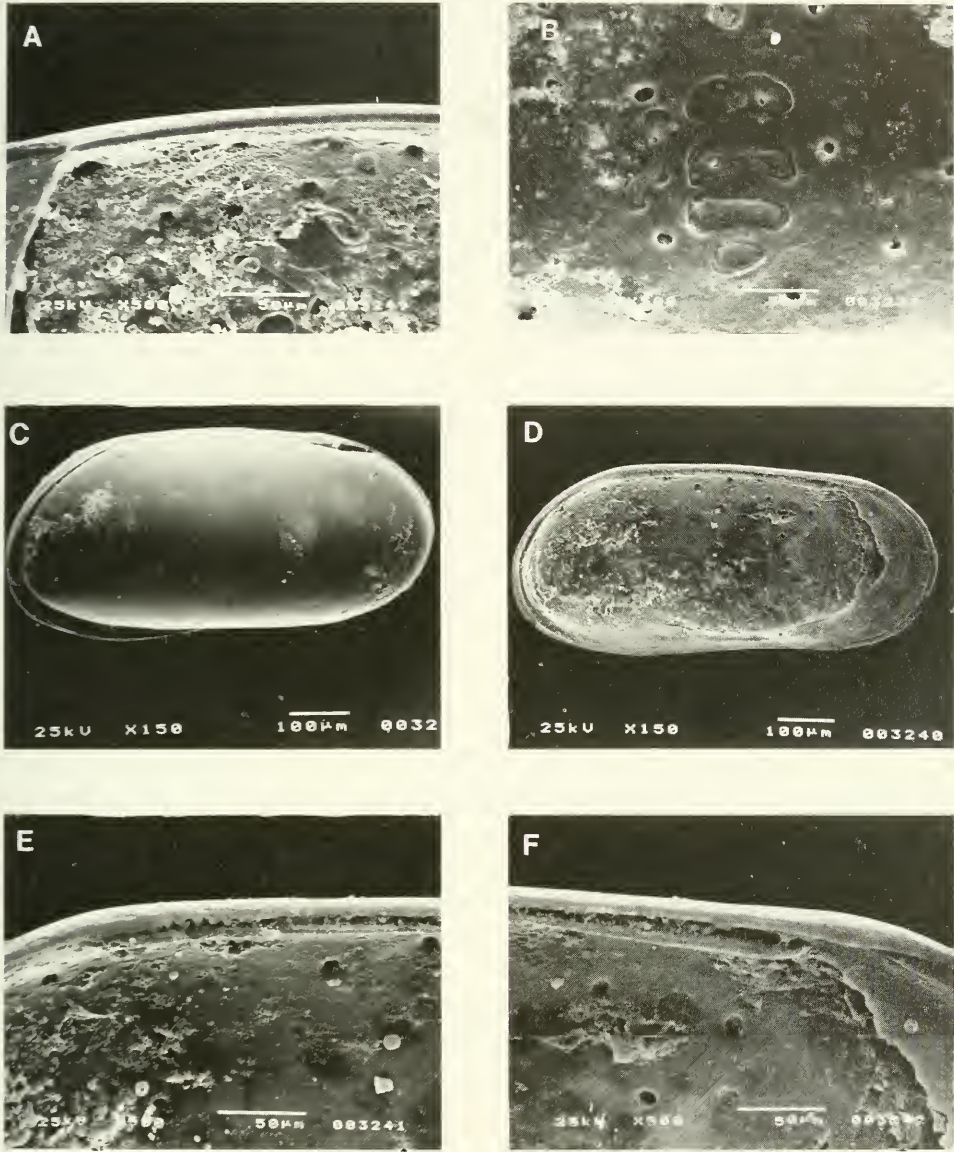


Fig. 36. *Parakrithella simpsoni* sp. nov. A. MF-0696, holotype, RV, TBD 6846, 95 m, ATE, SEM 3249. B. MF-0692, paratype, RV, TBD 6846, 95 m, MS, SEM 3233. C. MF-0693, paratype, C, TBD 6846, 95 m, right view, SEM 3237. D-F. MF-0694, paratype, LV, TBD 270, 131 m. D. Internal view, SEM 3240. E. PTE, SEM 3241. F. ATE, SEM 3242. Scales: A-B, E-F = 50 μ ; C-D = 100 μ .

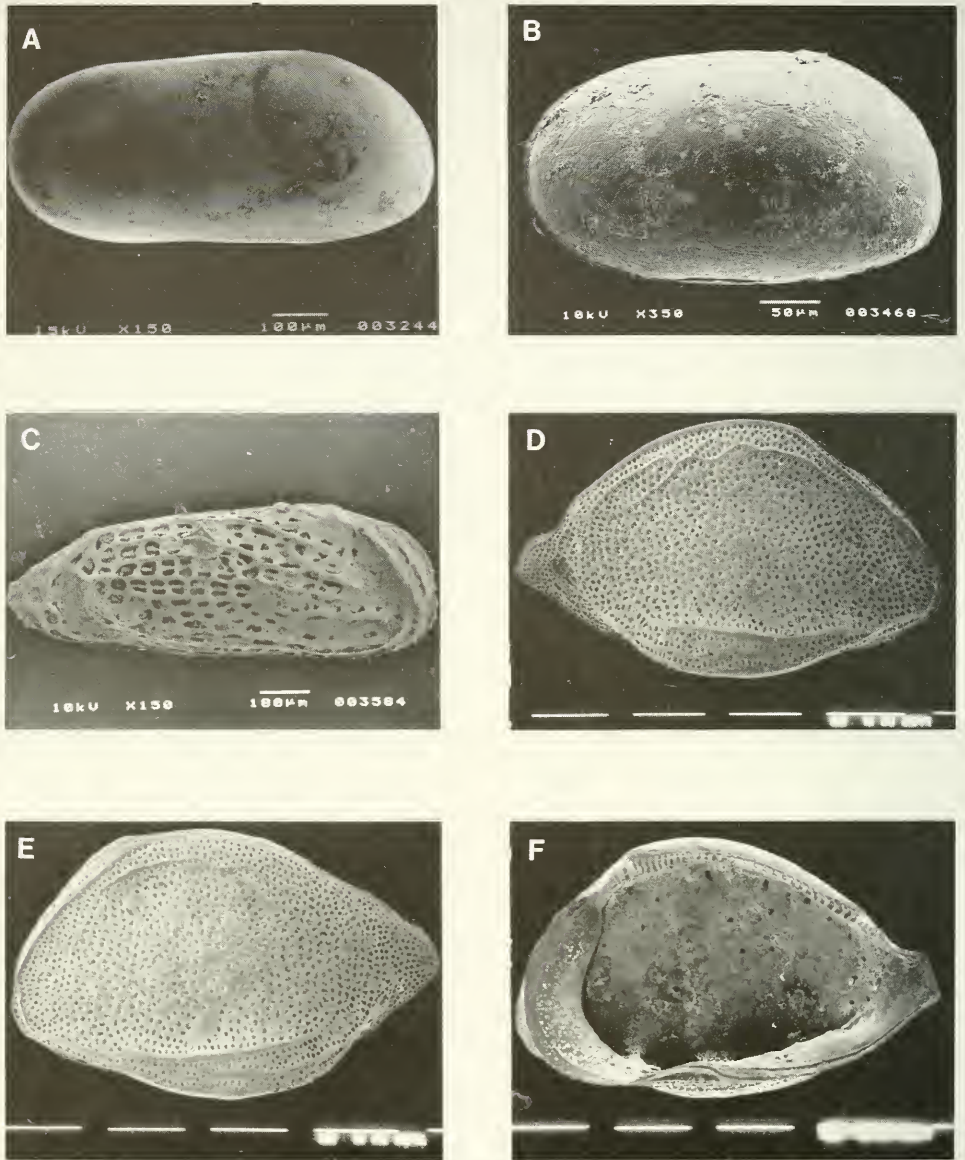


Fig. 37. A. *Parakrithella simpsoni* sp. nov., MF-0695, paratype, C, TBD 6846, 95 m, left view, SEM 3244. B. *Parakrithella* sp. 3468, MF-0765, LV, TBD 3007, 147 m, SEM 3468. C. *Doratocythere* sp. 3584, MF-0792, RV, TBD 2459, 300 m, SEM 3584. D-F. *Cytheropteron whatleyi* sp. nov., TBD 2974, 186 m. D. MF-0628, holotype, RV, SEM 2899. E. MF-0628, paratype, LV, SEM 2895. F. MF-0630, paratype, RV, internal view, SEM 2898. Scales: A, C-F = 100 μ ; B = 50 μ .

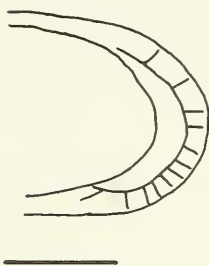


Fig. 38. Anterior marginal area of *Parakrithella simpsoni* sp. nov., MF-0798, paratype, LV, TBD 6823, 120 m.

only a gentle anterior convergence; the anterior and posterior extremities are slightly acuminate.

Internal features. Typical of the genus. The teeth in the right valve hinge are set at the posterior end, immediately anterior to the slight PCA. The vestibulae are moderately wide, anteriorly slightly asymmetric, being widest above mid-height. Nine short, simple, straight anterior RPC; eight posterior RPC. The MS are relatively small, consisting of four adductors (the dorsal one is subdivided) and two anterior scars, the posterior of which is irregular, elongate and lies at right angles to the adductors, and the anterior of which is very small and ellipsoidal.

Remarks

Parakrithella simpsoni sp. nov. is easily distinguished from the type species *P. pseudadonta* (Hanai) (Recent, Japan) by the strongly curved DM of the latter. *Parakrithella australis* McKenzie, 1967 (Recent, south Australia), is more similar in outline, but has numerous and complex AM RPC. The closest known species is *P. posterotunda* Whatley & Quanhong, 1987 (Recent, Malacca Straits), but this species has a more broadly rounded PM outline and considerably wider anterior MA.

Distribution

Parakrithella simpsoni is confined to sites west of the Cape Peninsula and one site south of False Bay (Fig. 39), where it generally constitutes 1–2 per cent of the ostracod population.

Modern specimens were recovered from all the sites, except the deepest, giving a modern depth range of 80–131 m.

Relict specimens occur over the depth range 80–160 m.

?*Parakrithella* sp. 3468

Fig. 37B

Illustrated material

	length	height
MF-0765, C, TBD 3007, 147 m	0,35	0,16

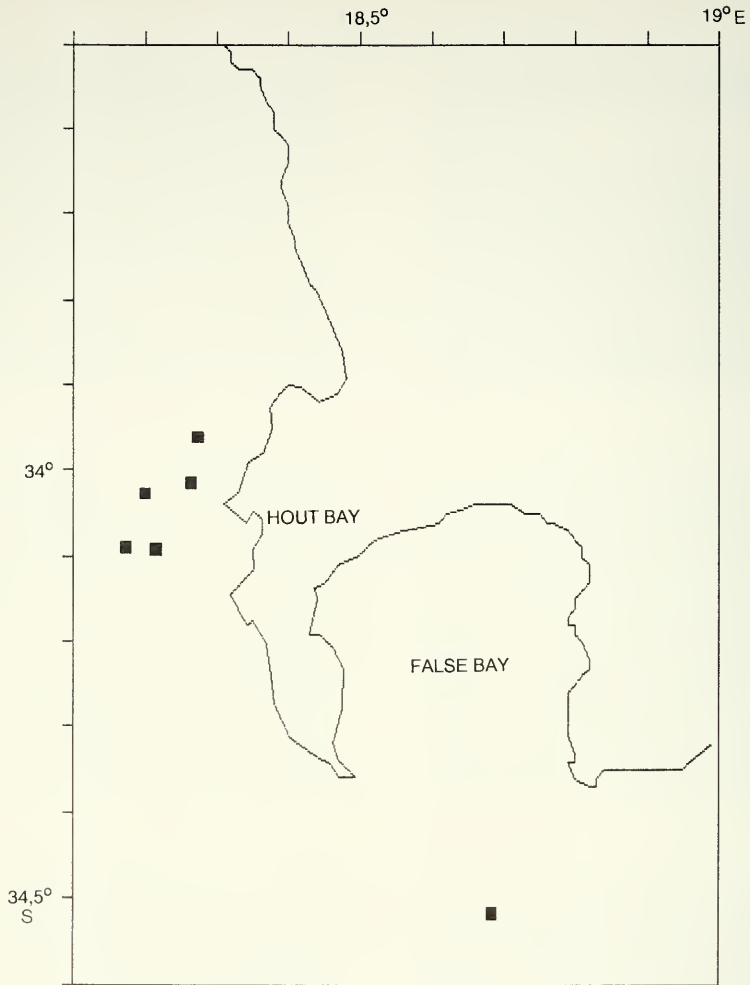


Fig. 39. Distribution of *Parakrithella simpsoni* sp. nov. Only the westernmost sample does not contain modern specimens.

Material

Two valves.

Remarks

A modern carapace. Lack of internal views precludes a confident generic assignment.

Distribution

This rare species was recovered from one site only (TBD 3007: 147 m) from the mid-shelf between Lüderitz and the Orange River.

Family **Campylocytherididae** Puri, 1960

Subfamily Campylocytheridinae Puri, 1960

Genus *Doratocythere* McKenzie, 1967

Doratocythere sp. 3584

Fig. 37C

Illustrated material

	length	height
MF-0792, RV, TBD 2459, 300 m	0,86	0,32

Material

One valve.

Remarks

This species is similar to *Doratocythere exilis* (Brady), which occurs abundantly on the continental shelf off south-western Africa in water depths between 40 m and 305 m (Dingle 1992). *Doratocythere* sp. 3584 differs from *D. exilis* in being significantly more elongate, being more laterally compressed, and having straighter DM and VM. Clearly the two species are closely related, and modern specimens of neither have been found.

A similar elongate species of *Doratocythere* occurs in west-coast Miocene sediments (unpublished personal data).

Distribution

This rare species has been found relict at one site only (TBD 2459: 300 m) on the outer shelf off Namaqualand.

Family **Cytheruridae** Müller, 1894

This family is represented by 29 species on the continental shelf of the south-eastern Atlantic, which compares with 34 recorded by Whatley *et al.* (1988) from the margins of the south-western Atlantic.

Genus *Cytheropteron* Sars, 1866

Fourteen species of *Cytheropteron* are known from the continental margin off south-western Africa (Dingle *et al.* 1990), making it the most diverse of the Quaternary ostracod genera. Nine of these species occur on the continental shelf (<400 m), of which seven are confined to it, whereas five species occur on the upper continental slope but do not extend into water depths greater than 950 m. Three species, which have previously been described by Dingle *et al.* (1990), are confined to water deeper than 950 m (*Cytheropteron* sp. 2909, *Cytheropteron* sp. 2914, and *C. cronini* Dingle, Lord & Boomer, 1990).

Despite its relatively large diversity, *Cytheropteron* is not an abundant element in the overall ostracod fauna off south-western Africa, constituting a mere 0,8 per cent. Locally, individual species are relatively more important but combined they seldom exceed 10 per cent.

In the south-western Atlantic, the genus is also relatively diverse, with the six species recorded by Whatley *et al.* (1988) from Argentina, the Falkland Islands, and various Antarctic and Subantarctic locations. None of the previous surveys around south-western Africa (e.g. Brady 1880; Klie 1940; Hartmann 1974) recorded the genus, mainly because they did not sample extensively on the continental shelf.

The fossil record of *Cytheropteron* is relatively good in southern Africa, with two species from the Upper Cretaceous (Dingle 1981) and at least twelve in the Palaeogene (Dingle 1976; Frewin 1987). Van den Bold (1966) recorded two species in the Mio-Pliocene of Gabon, one of which (*Cytheropteron* sp. A van den Bold, 1966) has subsequently been recovered in Quaternary sediments off the Congo estuary (Babinot & Kouyoumontzakis 1986).

Cytheropteron whatleyi sp. nov.

Fig. 37D–F, 40A–D

Cytheropteron sp. 1 Boomer, 1985: 53–54, pl. 4 (figs 59–60).

Derivation of name

This species is named for Professor R. C. Whatley (University College, Aberystwyth), for his important comparative studies on *Cytheropteron* of the south-western Atlantic.

Holotype

	length	height
MF-0628, RV, TBD 2974, 186 m	0,60	0,38

Paratypes

	length	height
MF-0629, LV, TBD 2974, 186 m	0,55	0,33
MF-0630, RV, TBD 2974, 186 m	0,55	0,32
MF-0631, LV, TBD 3863, 150 m	0,58	0,35

Material

109 valves.

Diagnosis

An elegant and delicately reticulate species of *Cytheropteron* with three narrow longitudinal ala ribs.

Description

External features. AM asymmetrically rounded, ventrally directed, PM caudate, slightly upturned in RV. DM strongly convex, particularly so in RV. VM almost straight, but in lateral view hidden by a broad ala with no distinct apex. Overall the surface is ornamented with fine reticulation that has no preferred orientation. There are several narrow, delicately drawn ribs: three lie along the ala keel, the ventral of which is continuous from the MA to the centre of the PM caudal process; the AM rib lies at the valve

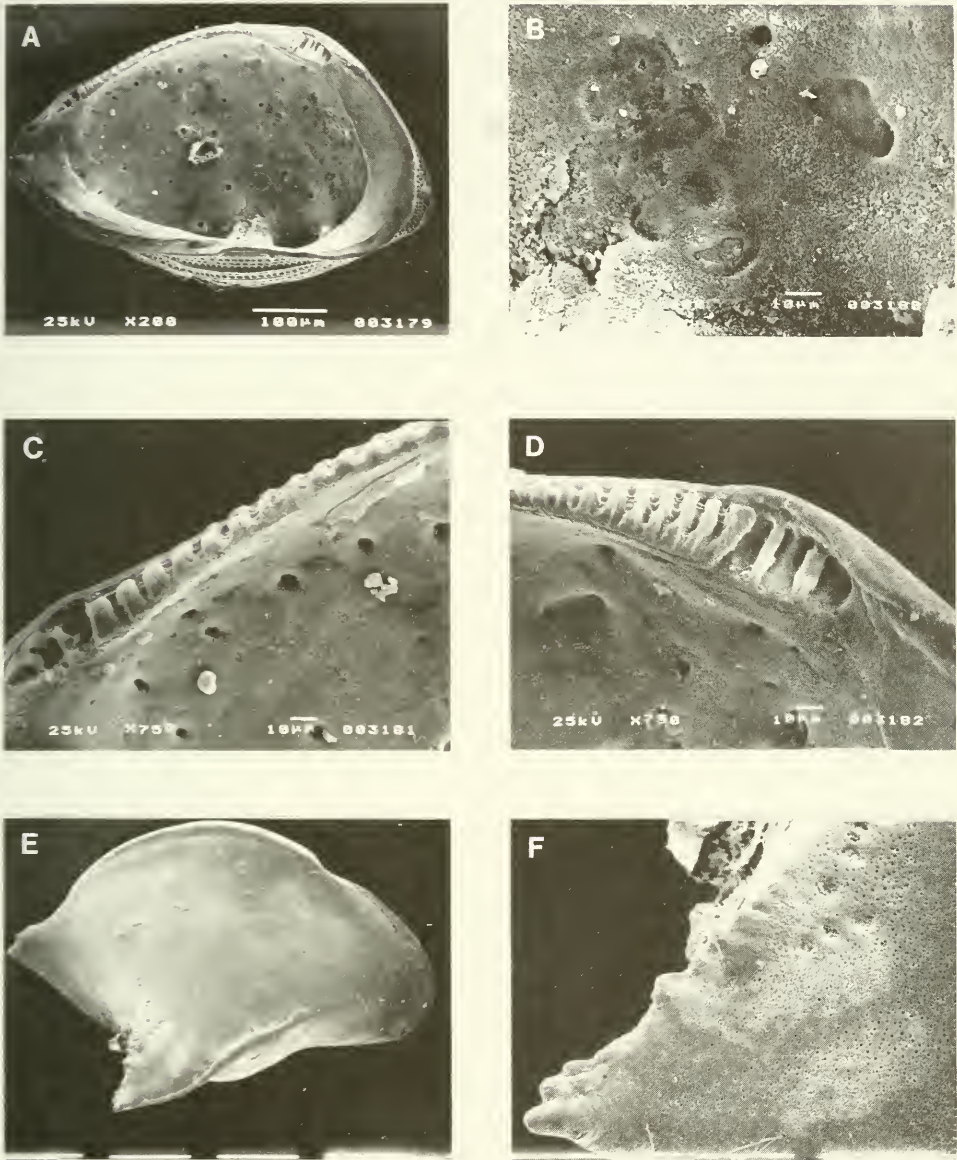


Fig. 40. A-D. *Cytheropteron whatleyi* sp. nov., MF-0631, paratype, LV, TBD 3863, 150 m. A. Internal view, SEM 3179. B. MS, SEM 3180. C. PTE, SEM 3181. D. ATE, SEM 3182. E-F. *Cytheropteron trinodosum* sp. nov., MF-0632, holotype, TBD 6824, 90 m. E. SEM 2888. F. Detail of ala, SEM 2890. Scales: A, E-F = 100 μ ; B-D = 10 μ .

edge and continues along the DM; a further dorsolateral rib lies sub-parallel to the DM following a sinuous course behind mid-length.

Internal features. Typical for the genus. The hinge is robust, antimerodont, with relatively short TE. MA moderately wide. There are four adductor MS, the first and third of which are subdivided, and an elongate anterior scar.

Remarks

Cytheropteron whatleyi sp. nov. bears a strong resemblance to *C. testudo* Sars, 1869, but they differ with the latter being posteriorly more acuminate, particularly in the LV, and the former having a more complex rib pattern on, and adjacent to, the DM. Whatley

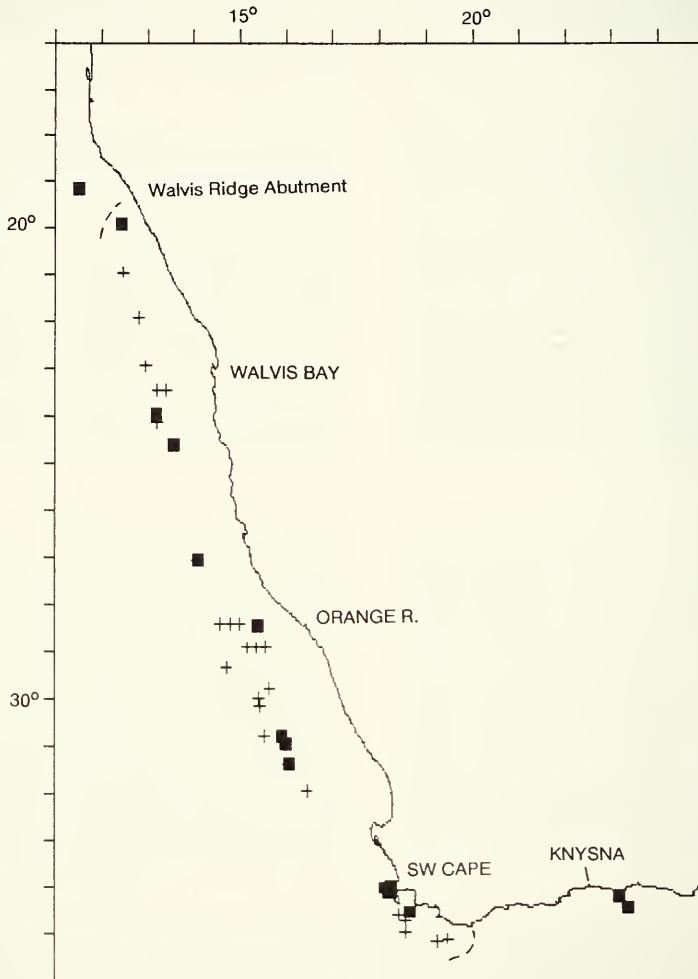


Fig. 41. Distribution of *Cytheropteron trinodosum* sp. nov. (black squares), and *C. whatleyi* sp. nov. (crosses, with dashed lines indicating northern and eastern limits) on the continental margin off south-western Africa. Sites near Knysna are after Keeler (1981).

& Coles (1987) and Whatley & Ayress (1988) have shown that *C. testudo* is a cosmopolitan taxon that occurs in Miocene–Quaternary sediments in all the world's major oceans. Sars (e.g. 1928) originally recorded the species from c. 240 m water depth off northern Norway, whereas Whatley & Coles (1987) have found it in Quaternary sediments at DSDP site 607 at 3 427 m in the North Atlantic, Benson (1977) recorded the species from Pleistocene sediments at DSDP site 22 in the South Atlantic, and Whatley & Downing (1984) have reported it in the Middle Miocene of south Australia.

A further similar species, within the group related to *C. testudo*, is *C. parawellmani* Whatley & Downing, 1984, from the Middle Miocene of south Australia. The latter differs from *C. whatleyi* in the course and shape of the dorsal margin and surface of the ala, and the more dorsally directed outline of the PM caudal process.

Cytheropteron whatleyi also resembles *C. litwini* Blaszyk, 1987, from the Oligocene of King George Island, Antarctic Peninsula, but Blaszyk's species has a prominent, continuous rib subparallel to the DM and a ventrally directed PM caudal process.

Instars of *C. gaussi* Müller, 1908, from Antarctica have a similar ornamentation to *C. whatleyi*, but possess a more complex ornamentation of ribs and nodes on the upper ala surface, and a more pointed and dorsally directed PM outline (e.g. see illustrations in Hartmann 1989).

Distribution

Cytheropteron whatleyi sp. nov. is the most widely distributed and abundant species of the genus on the continental shelf off south-western Africa, with a latitudinal range of 19,9° to 35°S (Fig. 41). Keeler (1981) did not record it on the eastern Agulhas Bank, which suggests that it is a cold-water taxon.

It is known only from relict specimens, which have regional UDL and LDL of 131 m and 475 m, respectively. The LDL increases northwards from the south-western Cape, where it lies at 220 m. A single valve at TBD 3458 off Walvis Bay in 725 m is probably allochthonous.

Cytheropteron trinodosum sp. nov.

Figs 40E–F, 42A–E, 43, 44A

Cytheropteron sp. B Keeler, 1981: 58–59, pl. 3 (figs 1–2).

Cytheropteron spp. Boomer, 1985: 51, pl. 1 (figs 11–12).

Derivation of name

tri, nodosa—Latin; reference to three nodes at the tip of the ala.

Holotype

	length	height
MF-0632, RV, TBD 6824, 90 m	0,51	0,28

Paratypes

	length	height
MF-0633, LV, TBD 6824, 90 m	0,52	0,27
MF-0634, RV, TBD 6847, 94 m	0,48	0,30
MF-0635, LV, TBD 6847, 94 m	0,53	0,25

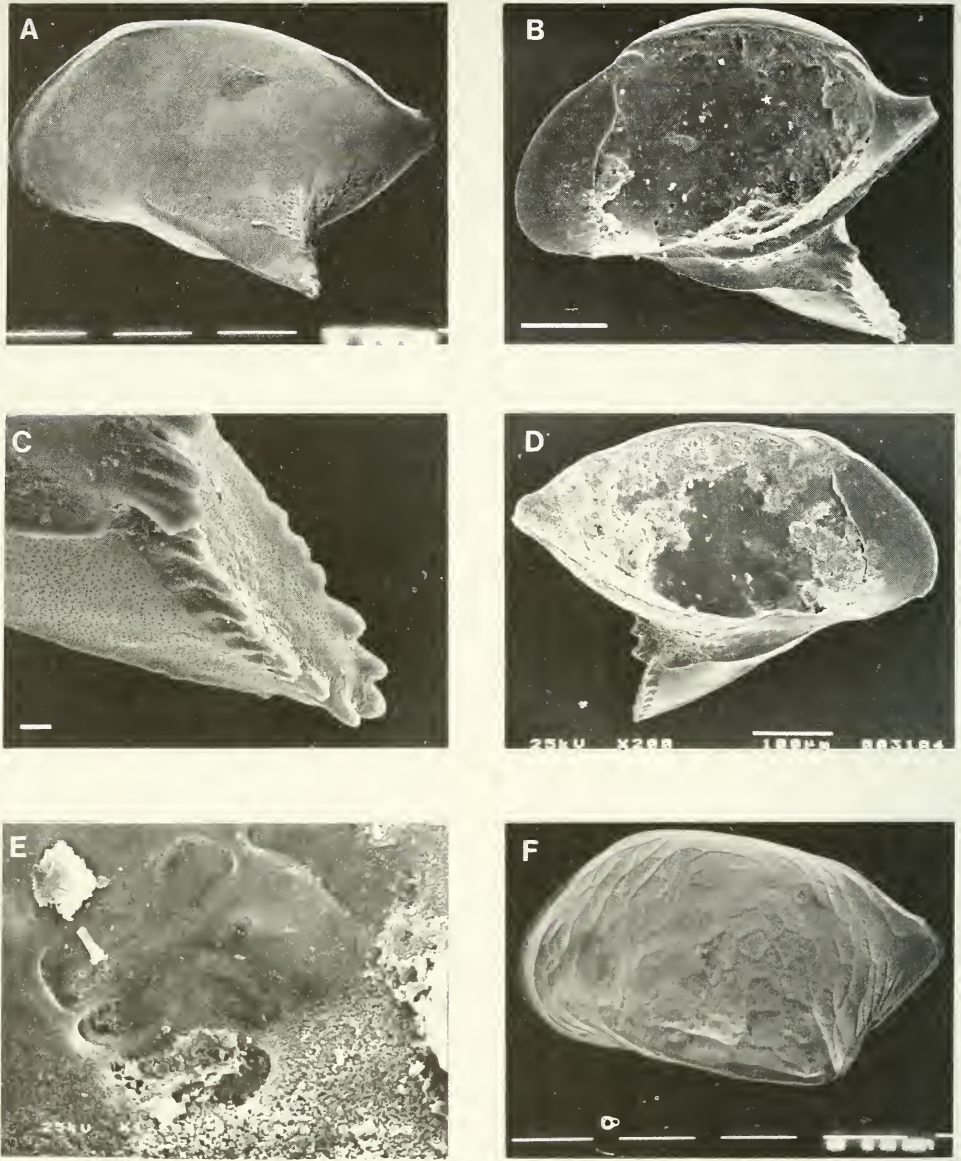


Fig. 42. A-E. *Cytheropteron trinodosum* sp. nov. A. MF-0633, paratype, LV, TBD 6824, 90 m, SEM 2892. B-C. MF-0634, paratype, RV, TBD 6847, 94 m. B. Internal view, SEM 3187. C. Detail of ala, SEM 3188. D-E. MF-0635, paratype, LV, TBD 6847, 94 m. D. Internal view, SEM 3184. E. MS, SEM 3185. F. *Cytheropteron cuneatum* sp. nov., MF-0638, holotype, LV, TBD 6836, 80 m, SEM 2887. Scales: A-B, D, F = 100 μ ; C, E = 10 μ .



Fig. 43. Muscle scars of *Cytheropteron trinodosum* sp. nov., paratype, MF-0635, LV, TBD 6847, 94 m.

Material

75 valves.

Diagnosis

Species of *Cytheropteron* with three small nodes on the posterior side of the ala apex.

Description

External features. Ovate outline dominated by strongly caudate PM, and lance-like ala. AM asymmetrically rounded, more drawn out and ventrally directed in RV. PM caudal process is dorsally deflected. DM strongly convex in RV, with a prominent anterodorsal notch, somewhat straighter in LV. VM gently convex. There is a prominent, lance-like ala with two flap-like processes on the trailing edge. Overall the valve surface is smooth, but there are several distinct features associated with the ala. There is a cord-like rib along the leading edge and three small nodes on the posterior side of the apex. These are only seen in well-preserved specimens and, in some examples, there is a tendency for the most distal node to extend and deflect dorsally and posteriorly, forming almost a hook. There are other small nodes proximal to the apex nodes and these give a serrated aspect to the ala. In addition, there are lines of fine puncta along the dorsal surface of the ala trailing edge and along the dorsal side of the leading edge cord-like rib, where it abuts the main lateral surface. These details are important for defining the species.

Internal features. MS consist of five vertical scars, the central of which is elongate and angled. The marginal areas are moderately wide, with small anterior vestibules and seven RPC. The two RPC at the AM apex diverge strongly in a V-arrangement, and the third RPC from the anterodorsal corner has a short, 'false' canal ventrally adjacent to it.

Remarks

There are several species of *Cytheropteron* that possess a large pointed lance-like ala, typical of which is *C. alatum* Sars, 1866. In general outline and overall ornamentation

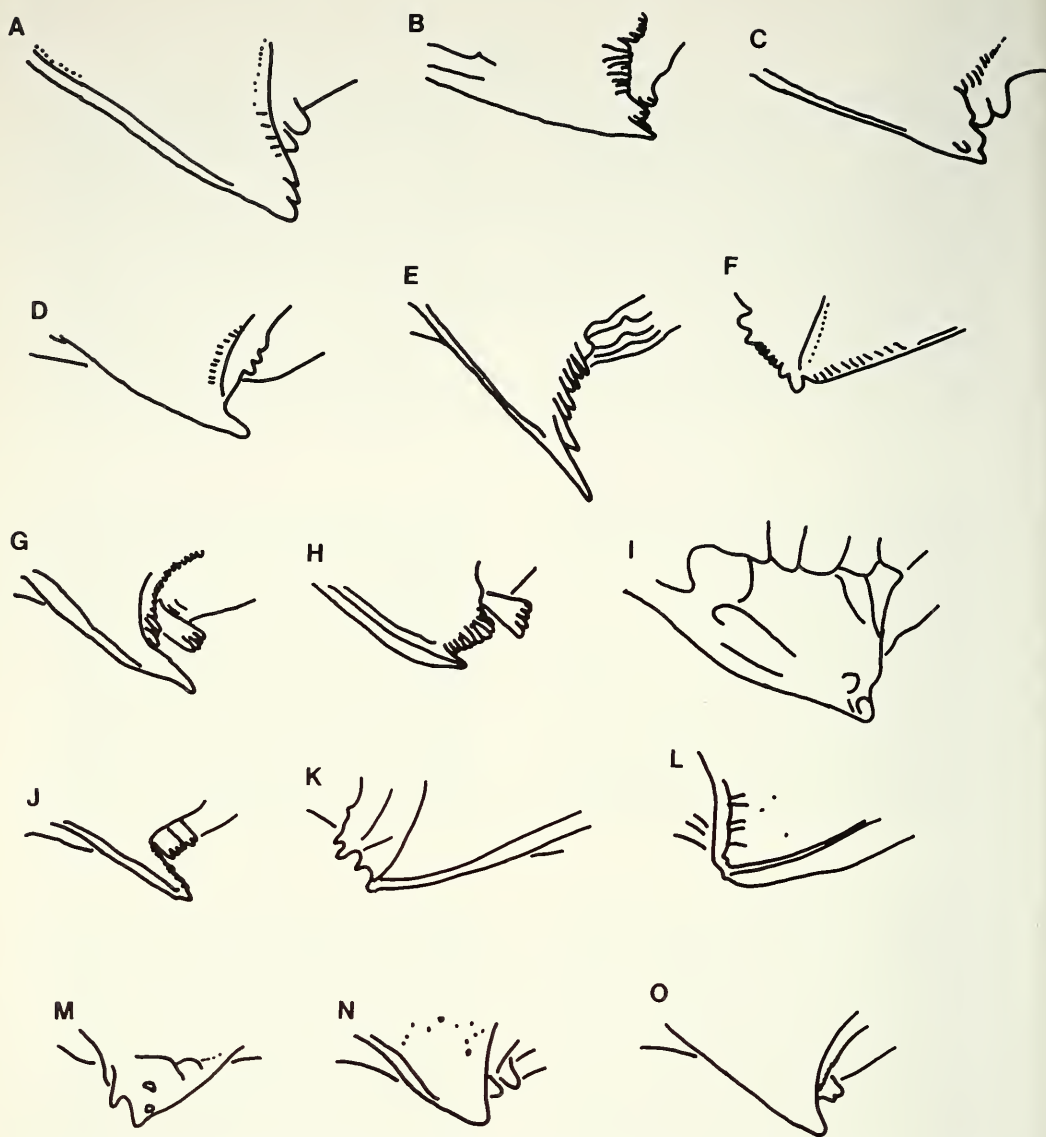


Fig. 44. Sketches of external lateral views of alae of 'Cytheropteron alatum' group of species. Modern species. A. *C. trinodosum* sp. nov., LV. B. *C. alatum* Sars, 1866, LV. C. *C. vespertilio* (Reuss, 1850), LV. D. *C. branchium* Whatley, Ayress & Downing, 1986, LV. E. *C. pherozigzag* Whatley & Masson, 1979, LV. F. *C. volantium* Whatley & Masson, 1979, RV. G. *Cytheropteron* sp. V Cronin, 1983, LV. H. *Cytheropteron* sp. D Cronin, 1983, LV. I. *C. excavovalatum* Whatley & Masson, 1979, LV. J. *C. pulcinella* Bonaduce, Masoli & Pugliese, 1978, LV. K. *C. aff. C. alatum* Sars, 1866 (in Bonaduce *et al.* 1988), RV. L. *C. inornatum* Brady & Robertson, 1872, RV. Fossil species. M. *C. bremeri* Dingle, 1981, RV, Maastrichtian. N. *C. cf. C. bremeri* (in Frewin 1987, Palaeogene). O. *C. aff. C. bremeri* (in Frewin 1987, Palaeogene).

tation, these species are close but, under scanning electron microscopy, the details of frills, ridges, denticles and puncta on the ala allow the various species to be easily discerned. Whatley & Masson (1979) have revised the taxonomy and re-illustrated *Cytheropteron* species from around Great Britain, including *C. alatum*, and Figure 44 shows sketches of this and other species that are similar to *C. trinodosum*. *Cytheropteron vespertilio* (Reuss, 1850), from the Miocene to Recent of north-western Europe and the Mediterranean, is particularly close to *C. trinodosum* sp. nov., but differs in having a somewhat shorter ala, which is less deflected ventrally, as well as having subtle differences in ornamentation. According to Whatley & Masson, *C. vespertilio* occurs in water depths that range 30–700 m (Breman 1976), with greatest abundances at 200–500 m.

Of particular interest are two pandemic species of *Cytheropteron* that fall within the '*Cytheropteron alatum*' group: *C. branchium* Whatley & Ayress, 1986, and *C. pherozigzag* Whatley & Ayress, 1986. Whatley & Ayress (1988) recorded these species in deep water in all three major oceans and, although neither is particularly close to *C. trinodosum* in details of ala morphology, they form a world-wide link between the more endemic species of the '*C. alatum*' group that are confined to shallower waters.

Fossil species of the '*C. alatum*' group have been reported in southern Africa by Dingle (1981) and Frewin (1987). From the Maastrichtian of Zululand *C. brenneri* Dingle, 1981, has a shorter and straighter ala, whereas from the Eocene of the Agulhas Bank, *Cytheropteron* cf. *C. brenneri* Frewin, 1987, and *Cytheropteron* aff. *C. brenneri* Frewin, 1987, differ from *C. trinodosum* in being punctate, and lacking a leading edge rib, respectively. The fragmented valve recorded by Dingle (1976), from the middle Eocene offshore Natal as *Cytheropteron* sp. 3, is probably conspecific with Frewin's (1987) *Cytheropteron* aff. *C. brenneri*.

Distribution

Cytheropteron trinodosum sp. nov. is the second-most abundant and widespread species of the genus on the continental shelf and upper slope off south-western Africa. It occurs sporadically along the length of the margin from 19,9°S (Walvis Ridge abutment shelf) to 34,5°S (south of False Bay), and on to the eastern Agulhas Bank (Keeler 1981; herein Fig. 41).

Modern and relict specimens occur over the entire latitudinal range of sites and both have similar UDL and LDL: modern, 90 m and 437 m; relict, 80 m and 453 m, respectively. In both cases there is a large increase in UDL and LDL from south to north.

Cytheropteron cuneatum sp. nov.

Figs 42F, 45A–B

Derivation of name

Cuneus—Latin, wedge; reference to wedge-shape of alae.

Holotype

	length	height
MF-0638, LV, TBD 6836, 80 m	0,50	0,27

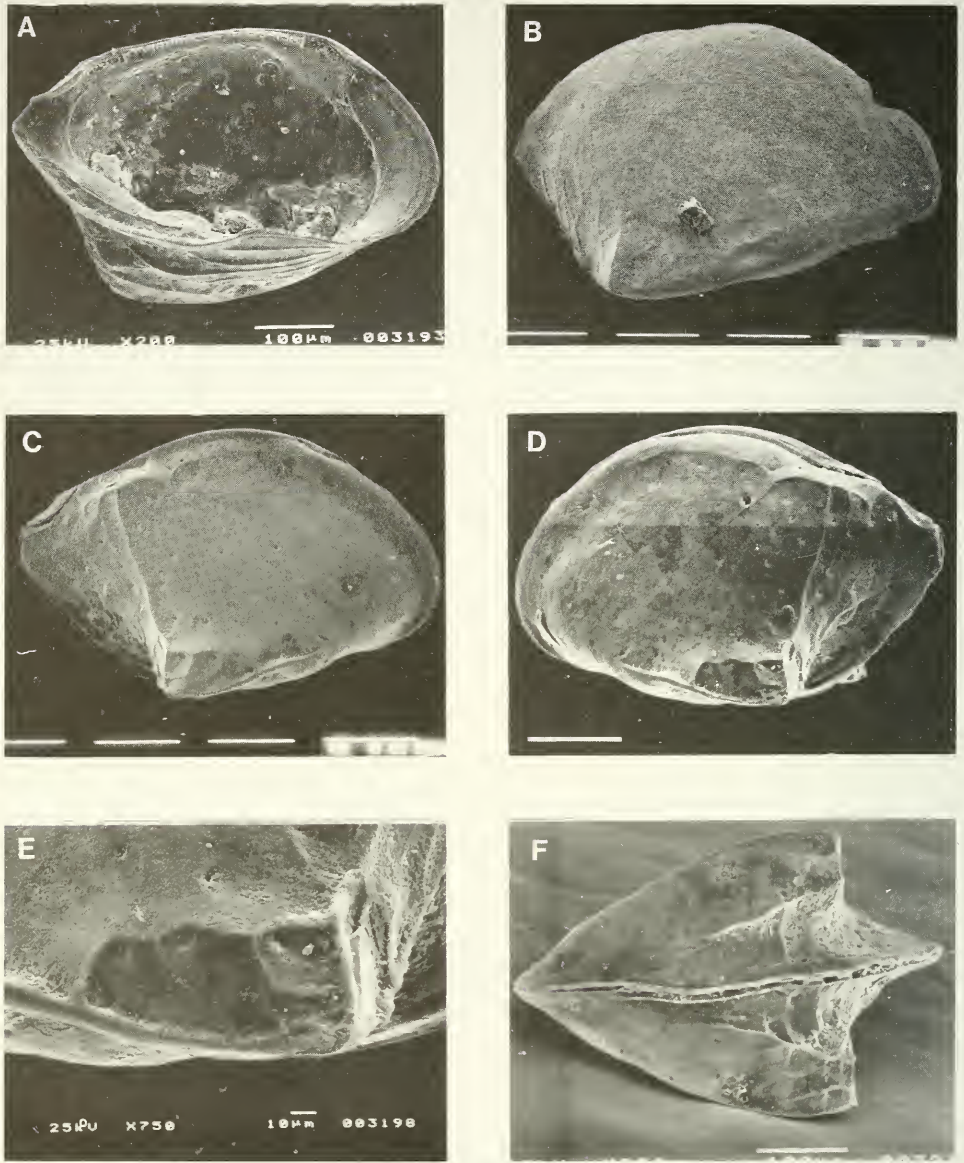


Fig. 45. A-B. *Cytheropteron cuneatum* sp. nov., TBD 6836, 80 m. A. MF-0638, holotype, LV, internal view, SEM 3193. B. MF-0639, paratype, RV, SEM 2884. C-F. *Cytheropteron frewinae* sp. nov., MF-0640, holotype, C. TBD 6823, 120 m. C. Right view, SEM 2894. D. Left view, SEM 3196. E. Detail of left ala, SEM 3198. F. Ventral view, SEM 3215. Scales: A-D, F = 100 μ , E = 10 μ .

Paratype

	length	height
MF-0639, RV, TBD 6836, 80 m	0,50	0,30

Material

Four valves.

Diagnosis

Species of *Cytheropteron* with a broad, wedge-shape ala, and ornamented overall with a lace-like pattern of fine ribs and punctae.

Description

External features. Asymmetrically rounded AM, caudate PM, upturned dorsally. DM in LV is straight, sloping posteriorly, with a high ACA; in LV DM is broadly convex, the sweep of the arc incorporating the AM and dorsal part of the PM. VM is straight, but mainly hidden by broad, wedge-shape ala terminating in a blunt apex that is deflected only slightly posteriorly and ventrally. Overall the valve surface is covered in fine ribs and intercostal riblets that create a lace-like pattern. The ribs are particularly prominent on the posterior side of the ala. Intercostal areas are finely punctate. There are two indistinct ribs running along the ala leading edge.

Internal features. Poorly known. The hinge is typical of the genus but relatively weak, with a finely crenulate ME. MS not seen. MA moderately wide, with few RPC.

Remarks

Although *C. cuneatum* is morphologically typical of the genus, none of the other local species of *Cytheropteron* is particularly close to it. The same is true for the north-western European shelf species (e.g. Whatley & Masson 1979) and those illustrated by Neale (1967) and Whatley *et al.* (1988) from the south-western Atlantic and Antarctica, although the wedge-shaped ala of *C. gausi* Müller, 1908, is reminiscent of *C. cuneatum*. However, the ornamentation and valve outline of the two species differ on many points. *Cytheropteron gausi* is a deep-water taxon (990–2 370 m) in Antarctica and the Subantarctic islands of the south-western Atlantic (Müller 1908; Neale 1967; Hartmann 1987; Whatley *et al.* 1988).

Distribution

This rare species was recorded at one site only (TBD 6836; 80 m), west of the Cape Peninsula (Fig. 46). Both modern and relict specimens were present in this sample.

Cytheropteron frewinae sp. nov.

Fig. 45C–F

Cytheropteron (Aversovalva) sp. A524 Frewin, 1987: 33–34, pl. 9E–G, text-figs 2.7, 2.8.

Derivation of name

This species is named for Joanna Frewin (formerly at the University of the Western Cape), who first reported this species.

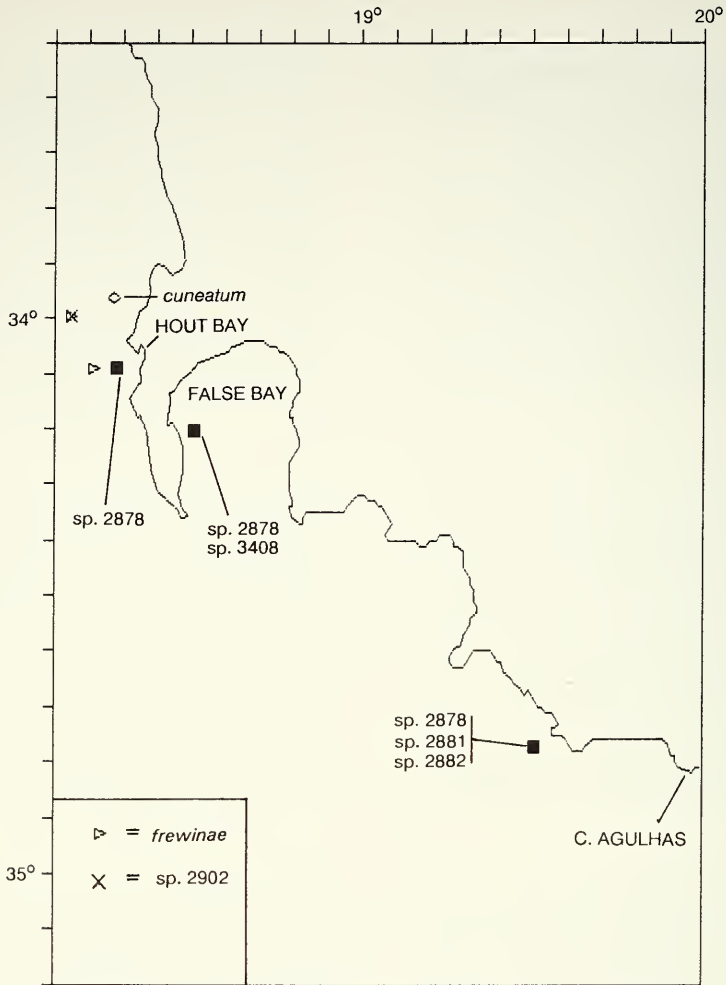


Fig. 46. Distribution of various species of *Cytheroapteron* on the continental margin between Cape Agulhas and the Cape Peninsula.

Holotype

	length	height
MF-0640, C, TBD 6823, 120 m	0,45	0,28

Material

Five valves.

Diagnosis

Species of *Cytheroapteron* with a prominent straight ridge running from the apex of the ala to the PCA, and with three small conchoidally-shaped depressions on the dorsal surface of the ala apex.

Description

External features. Asymmetrically rounded AM, PM with caudal process situated well above mid-height. DM broadly convex, VM short convex. Overall lateral outline is elliptical. Ala is short, ventrally deflected, with an angular, quadrate apex, and does not extend below line of VM. A prominent straight ridge runs from the ala apex to the PCA. A ridge runs thence to the ACA parallel to the DM. Immediately anterior to the PCA, the dorsal ridge is broken and a further very fine ridge, which has the appearance of a crack on the valve surface, runs diagonally forward across the central part of the valve. At the ala apex there are three conchoidal-like depressions that give the ala the aspect of a chipped flint artefact. Several short, sub-vertical ribs enhance this 'fractured' aspect in the triangular-shaped posterior area. A narrow sinuous rib runs from the ala apex along the ala leading edge.

Internal views. These are not available from my material. Frewin (1987) illustrated the species and her plate 9F–G shows a modified hemimerodont hinge, in which the smooth LV ME bar has enlarged and dentate posterior and anterior ends.

Remarks

This species was first recorded by Frewin (1987) from Eocene strata on the eastern Agulhas Bank. My material appears to be identical with hers. *Cytheropteron frewinae* resembles *Cytheropteron inornatum* Brady & Robertson, 1872, in their joint possession of a ridge running from the ala apex to the PCA, and a small diagonal ridge from the PCA across the central valve area. They differ in valve outline, which is more elongate in *C. inornatum*, and in the small concave depressions on the ala apex in *C. frewinae*. *Cytheropteron inornatum* occurs in relatively shallow waters (30–50 m) between 50° and 58°N around the British Isles, and to depths greater than 150 m in the Adriatic Sea (Whatley & Masson 1979).

Another similar species (*Cytheropteron* sp. S) has been reported from water depths of 105–1 029 m on the continental margin of the south-eastern USA (Cronin 1983). Cronin's species lacks the diagonal PCA to valve-centre ridge of *C. frewinae*, but has a very similar overall shape and angular aspect. None of the species of *Cytheropteron* from the south-western Atlantic illustrated by Whatley *et al.* (1988) is similar to *C. frewinae*.

Distribution

This rare species was recovered from two sites west of Hout Bay (Fig. 46), with UDL and LDL of 120 m and 140 m, respectively. Relict valves occur at both sites, and modern valves at the shallower site.

Cytheropteron aff. *C. frewinae*

Fig. 47A

Illustrated material

	length	height
MF-0637, RV, TBD 3921, 738 m	0,53	0,30

Material

One valve.

Remarks

A single valve belonging to the '*C. alatum*' group that is probably a new species. It has affinities with *C. frewinae*; in particular, it possesses a fine ridge that is directed from the PCA to the valve centre, and two narrow slits along the trailing edge of the ala. In contrast, *Cytheropteron* aff. *C. frewinae* lacks the sharp ridge that joins the PCA and the ala apex. Overall, the valve has an elongate dolphin shape and, in this respects, it is similar to *Cytheropteron* sp. 2914 Dingle, Lord & Boomer, 1990, from site TBD 3355 at 2 070 m.

Distribution

Found only at site TBD 3921 (19,1°S) on the Walvis Ridge abutment shelf, at a water depth of 738 m.

Indeterminate species of Cytheropteron

The following species are left in open nomenclature because the quantity and/or quality of material precludes the erection of new species.

Cytheropteron sp. 2878

Fig. 47B

Illustrated material

	length	height
MF-0642, RV, TBD 5254, 40 m	0,33	0,20

Material

Seven valves.

Remarks

This is a small species with a broadly rounded ala, on the dorsal surface of which there faint longitudinal ribs. It may be conspecific with the *Cytheropteron (Aversoalva)* sp. A530, illustrated by Frewin (1987) from the Eocene of the eastern Agulhas Bank, but my material is not sufficiently well preserved to make a satisfactory comparison.

Distribution

This rare species has been encountered at three sites off the south-western Cape: in the entrance to Hout Bay (TBD 6824: 90 m), in False Bay (TBD 5254: 40 m), and immediately west of Cape Agulhas (TBD 344: 73 m) (Fig. 46). Modern valves were recovered from the two shallower sites, whereas relict specimens occurred in False Bay and Hout Bay.

Cytheropteron sp. 2881

Fig. 47C

Illustrated material

	length	height
MF-0643, RV, TBD 344, 73 m	0,35	0,23

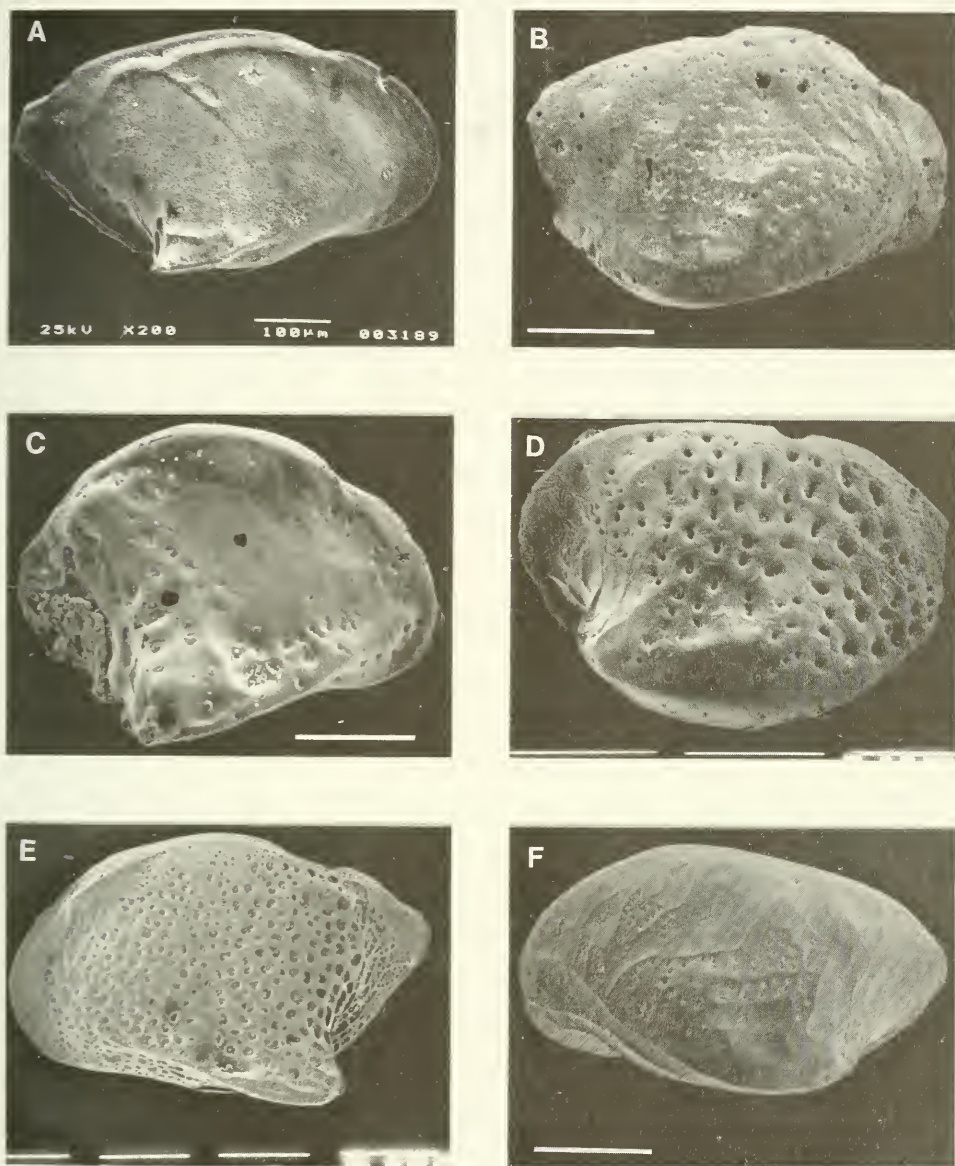


Fig. 47. A. *Cytheropteron* aff. *C. frewinae* sp. nov., MF-0637, RV, TBD 3921, 738 m, SEM 3189. B. *Cytheropteron* sp. 2878, MF-0642, RV, TBD 5254, 40 m, SEM 2878. C. *Cytheropteron* sp. 2881, MF-0643, TBD 344, 73 m, SEM 2881. D. *Cytheropteron* sp. 2882, MF-0644, RV, TBD 344, 73 m, SEM 2882. E. *Cytheropteron* sp. 2902, MF-0645, LV, TBD 3587, 140 m, SEM 2902. F. *Cytheropteron* sp. 3408, MF-0731, LV, TBD 5254, 40 m, SEM 3408. Scales: all 100 μ .

Material

One valve.

Remarks

I am not aware of any species of *Cytheropteron* that closely resembles *Cytheropteron* sp. 2881. It is small and has a relatively large ala with a thick leading edge ridge. The dorsal and posteroventral areas of the valve are strongly compressed, and there are numerous small pits on the valve surface.

Distribution

One modern valve was recovered from site TBD 344 (73 m), immediately west of Cape Agulhas.

Cytheropteron sp. 2882

Fig. 47D

Illustrated material

	length	height
MF-0644, RV, TBD 344, 73 m	20,34	0,20

Material

One valve.

Remarks

This is a very distinctive, small species of *Cytheropteron*, in the ala of which is a massive ridge that dominates the lateral view. It has a flattened lateral surface, and several irregular depressions and pits on its dorsal surface. The dorsal half of the valve has distinctive, vertically elongate pits that impart a cuneiform appearance to the ornamentation.

Distribution

One, probably modern, valve was recovered from site TBD 344 (73 m), immediately west of Cape Agulhas.

Cytheropteron sp. 2902

Fig. 47E

Illustrated material

	length	height
MF-0645, LV, TBD 3587, 140 m	0,49	0,30

Material

One valve.

Remarks

This species has a relatively small, acuminate ala, and an overall valve surface that is finely reticulate and punctate. It is similar to other punctate/finely reticulate species such as *C. punctatum* Brady, 1868b, and *C. miurense* Hanai, 1957, but differs in details of outline, ala shape and ornamentation. None of the Eocene species recorded by Frewin (1987) from the Agulhas Bank is similar to *Cytheropteron* sp. 2902.

Distribution

One relict valve was recovered from site TBD 3587 (140 m), west of Hout Bay.

Cytheropteron sp. 3408

Fig. 47F

Illustrated material

	length	height
MF-0731, LV, TBD 5254, 40 m	0,37	0,19

Material

One valve.

Remarks

This species has a distinctively sculptured surface with fine, widely spaced reticulation. Intercostal areas are strongly punctate in the central part of the valve. The ala is broad and blunt, and has three widely spaced ribs along its leading edge.

Distribution

One, probably modern, valve was recovered from site TBD 5254 in False Bay (40 m).

Summary of the distribution of the genus Cytheropteron on the continental shelf

The latitudinal distribution of the 10 species of *Cytheropteron* that occur in water shallower than 945 m is shown in Figures 41 and 46, whereas the abundance variations of the main species are shown in Figure 48. Despite being the most diverse genus on the margin off south-western Africa, *Cytheropteron* accounts for only 0,85 per cent of the total ostracod populations (<945 m).

With the exception of a single valve of *Cytheropteron* aff. *C. frewinae* on the Walvis Ridge abutment, the shelf north of the Cape Peninsula is populated by only two species—*C. trinodosum* and *C. whatleyi*. Two areas, north-west of Lüderitz, and between the northern Cape Peninsula and the southern Namaqualand shelf, are barren of the genus. In contrast, the shelf around the Cape Peninsula contains six species, and the area off Cape Agulhas five.

There are large variations in diversity and abundance of *Cytheropteron* with water depth. Greatest diversity is found on the inner shelf, with six species in depths less than 100 m (all from the south-western Cape), and four species between 100 m and 200 m. Diversity declines in deeper water, with only *C. trinodosum* and *C. whatleyi* populating

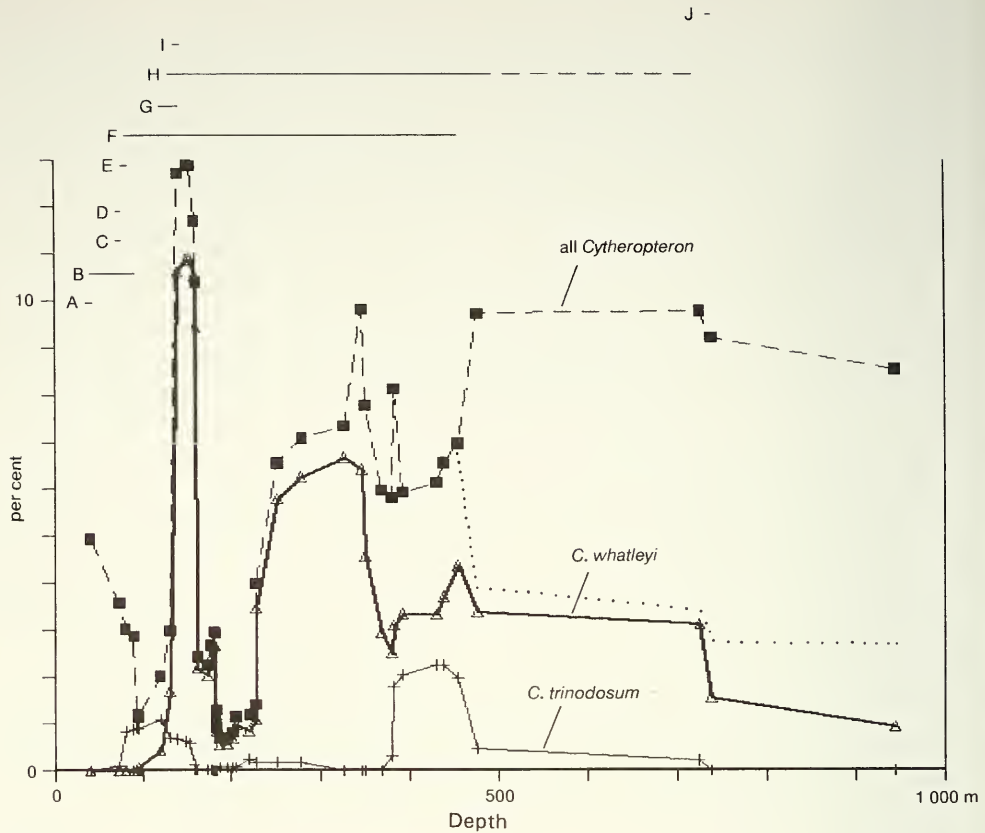


Fig. 48. Depth ranges (bars) of various species of *Cytheropteron* that occur in water depths <950 m. Graphs show the percentage of the total ostracod fauna for *C. whatleyi*, *C. trinodosum*, and all *Cytheropteron*. Note that the single valve of *C. aff. C. frewinae* (J) within a small sample distorts the smoothed 'all *Cytheropteron*' curve significantly. The dotted line represents this curve with no distortion for this sample. A = *Cytheropteron* sp. 3408. B = *Cytheropteron* sp. 2878. C = *Cytheropteron* sp. 2881. D = *Cytheropteron* sp. 2882. E = *C. cuneatum*. F = *C. trinodosum*. G = *C. frewinae*. H = *C. whatleyi*. I = *Cytheropteron* sp. 2902. and J = *C. aff. C. frewinae*.

the outer shelf and upper slope, except for a single valve of *Cytheropteron* aff. *C. frewinae* on the Walvis Ridge abutment.

The abundance of *Cytheropteron* primarily reflects the combined abundances of *C. trinodosum* and *C. whatleyi*, and only shallower than 100 m do the minor species affect the values. *Cytheropteron whatleyi* has two abundance peaks: at 150 m and 300 m, whereas *C. trinodosum* has its greatest abundance at c. 400 m. There is a low in *Cytheropteron* values in the vicinity of 200 m, and it may be significant that none of the minor species (except *Cytheropteron* aff. *C. frewinae*) occur below this depth.

Below 220 m there is an increase in abundance of the genus (to 7% of the ostracod fauna), rising to 10 per cent at 500 m. Values steadily decline in deeper water, and reach a low near the base of the AAIW salinity minimum zone on the middle continental slope (c. 1 000 m) (see Dingle *et al.* 1990, fig. 8).

Genus *Cytherura* Sars, 1866*Cytherura siesseri* sp. nov.

Fig. 49A-E

Derivation of name

This species is named for Professor W. G. Siesser (Vanderbilt University, Nashville), for his contributions to Southern African Cenozoic stratigraphy.

Holotype

	length	height
MF-0745, RV, TBD 6824, 90 m	0,56	0,25

Paratypes

	length	height
MF-0744, LV, TBD 6824, 90 m	0,69	0,30
MF-0746, LV, TBD 6824, 90 m	0,64	0,30

Material

Seven valves.

Diagnosis

Elongate species of *Cytherura* ornamented with faint longitudinal depressions in the anterior area, and a distinctive chevron arrangement of small punctae posteromedially.

Description

External features. Elongate ovate outline. Asymmetrically curved AM, ventrally directed. PM caudate, with dorsally directed process. DM broadly convex, VM weakly concave in central portion with distinct inflation posteriorly. Maximum valve height is at about three-quarter valve length. Valve surface smooth, except for faint longitudinal depressions that are most prominent anteriorly. There is a distinctive chevron pattern of four lines of small punctae on the crest of the posteromedian valve inflation.

Internal features. MA narrow, although details thereof were not seen. Hinge merodont (probably hemimerodont). MS consist of a line of four rounded adductors with two anterior scars in line with the dorsal-most adductor.

Remarks

This species is placed in *Cytherura* because it has narrow marginal areas. Otherwise, its overall shape is similar to two previously described species belonging to *Semicytherura*, viz: *S. clandestina* Whatley, Chadwick, Coxill & Toy, 1988, from the continental shelf and coast of northern Argentina, and ?*S. dimorpha* Hartmann, 1974, from the Luanda coastal area in Angola. *Cytherura siesseri* differs from both these species in details of outline (it is more elongate) and ornamentation (presence of the posteromedian chevrons of pits). It is not especially close to other cytherurids from southern Africa.

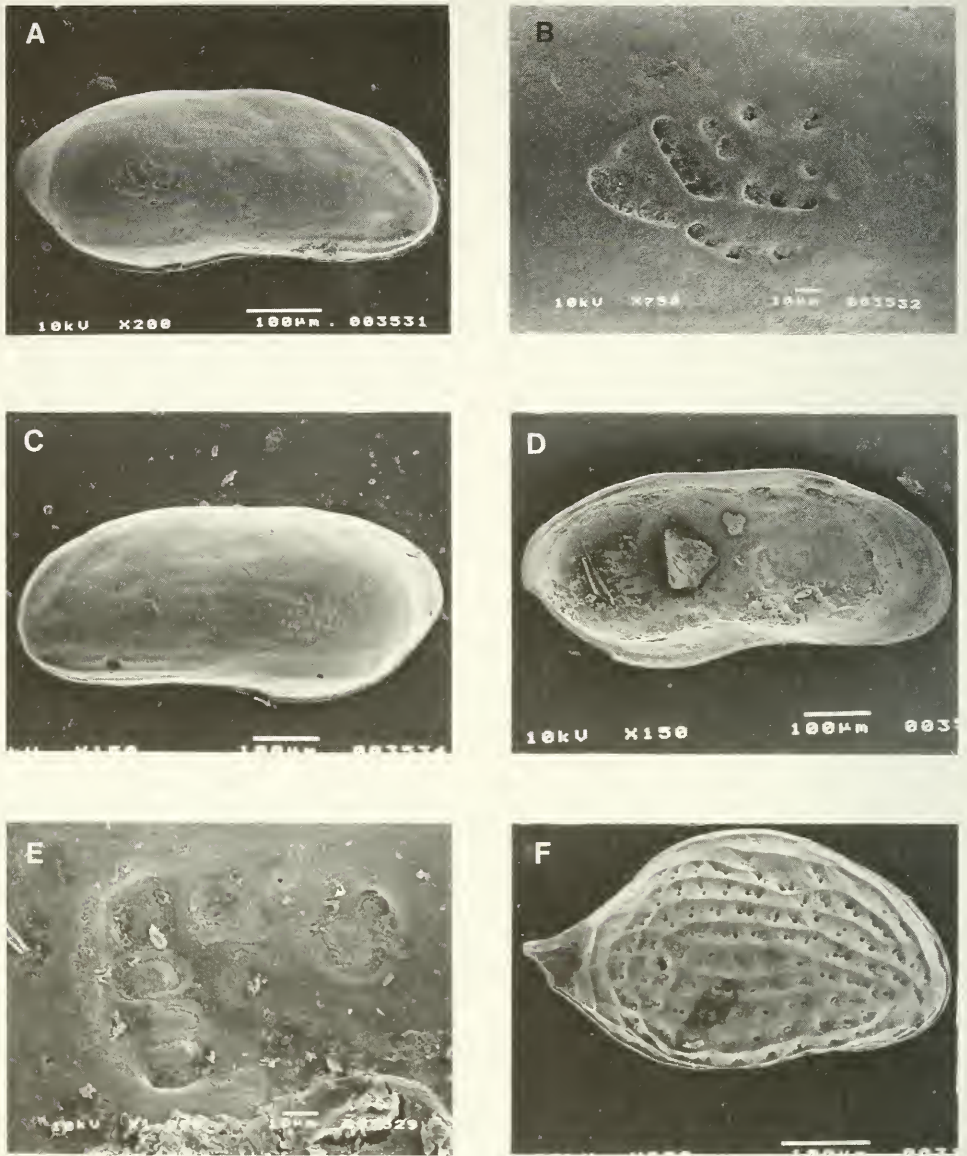


Fig 49. A-E. *Cytherura siesseri* sp. nov. TBD 6824, 90 m. A-B MF-0745, holotype, RV. A. SEM 3531. B. Detail of ornamentation in posteroventral region, SEM 3532. C. MF-0746, paratype, LV, SEM 3534. D-E. MF-0744, LV, paratype. D. Internal view, SEM 3525. E. MS, SEM 3529. F. *Kangarina mucronata* (Brady, 1880), MF-0686, RV, TBD 6847, 94 m, SEM 3199.

Scale: A, C-D, F = 100 μ , B, E = 10 μ .

Distribution

This species is recorded at one site (TBD 6824: 90 m) west of the Cape Peninsula, where six modern and one relict valve were collected.

Genus *Kangarina* Coryell & Fields, 1937

Three species of this genus are known from the continental shelf off south-western Africa. In contrast, Whatley *et al.* (1988) did not record the genus from the south-western Atlantic.

Kangarina mucronata (Brady, 1880)

Figs 49F, 50A–B

Cytherura mucronata Brady, 1880: 133–134, pl. 32 (figs 9a–d). Puri & Hulings, 1976: 305, pl. 21 (figs 11–12).

Illustrated material

	length	height
MF-0686, C, TBD 6847, 94 m	0,48	0,25
MF-0687, C, TBD 6847, 94 m	0,46	0,25
MF-0688, C, TBD 5254, 40 m	0,45	0,25
MF-0689, C, TBD 5254, 40 m	0,45	0,24

Material

36 valves.

Remarks

This species is placed in the genus *Kangarina* because the ventral margin is strongly concave anterior to mid-length. The illustrations herein are the first to show details of the ornamentation, MA and hinge of Brady's species.

Distribution

Brady (1880) recorded *Kangarina mucronata* from the 'Challenger' station in False Bay (Simon's Bay). The present specimens were recovered from one site in False Bay (TBD 5254) and three sites west of the Cape Peninsula (TBD 6836, 6824, 6847). The UDL and LDL are 40 m and 90 m, respectively.

Kangarina sola sp. nov.

Figs 50C–F, 51A

Kangarina sp. Keeler, 1981: 68–69, pl. 3 (fig. 12).

Derivation of name

sol—Latin, sun; fanciful reference to sun-shaped ornamentation pattern in the central dorsal part of the valve.

Holotype

	length	height
MF-0734, RV, TBD 344, 73 m	0,35	0,20

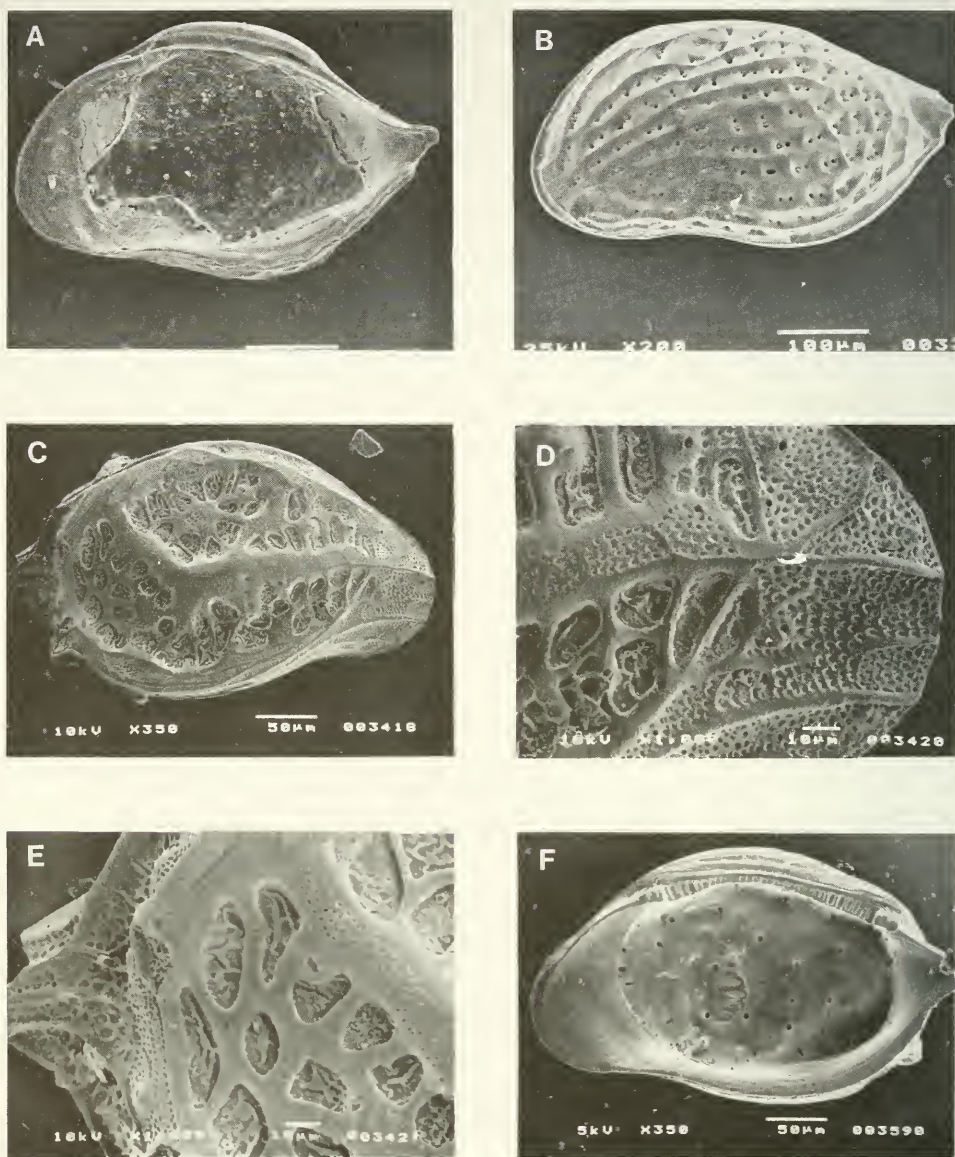


Fig. 50. A–B. *Kangarina mucronata* (Brady, 1880), TBD 6847, 94 m. A. MF-0686, RV, internal view, SEM 3221. B. MF-0687, LV, SEM 3201. C–F. *Kangarina sola* sp. nov. MF-0734, holotype, RV, TBD 344, 73 m. C. SEM 3418. D. Detail of anterior ornamentation, SEM 3420. E. Detail of posterior ornamentation, SEM 3421. F. Interior view, SEM 3590. Scales: A–B = 100 μ , C, F = 50 μ , D–E = 10 μ .

Material

One valve.

Diagnosis

Species of *Kangarina* with large sun-shaped ornament (central boss with fine radial ribs) in a central location dorsal to the main longitudinal median ridge.

Description

External features. A small, globular species with a narrow, acutely rounded AM that is ventrally deflected. PM somewhat truncated with a small, sharp caudal process at about mid-height. DM broadly rounded. VM strongly convex at about mid-length, with a concavity anterior to mid-length. Surface ornamentation very strong, with a massive longitudinal median ridge that commences near the posterodorsal margin and proceeds via the SCT to the vicinity of the AM. The dorso- and ventrolateral areas are also raised and, together with the median ridge and the AM area, are ornamented with fine punctae and narrow imbricating riblets. The main intercostal areas are relatively deeply sunken, and filled with a coarse reticulation and very fine, irregular inter-mural riblets. In a central position, dorsal to the median ridge, a large sun-shaped or cartwheel pattern dominates the valve.

Internal features. Wide anterior MA. Curved, robust antimerodont hinge with small subdivided TE and strongly crenulate ME, with larger anterior and posterior sectors. Ovate cluster of four adductor MS and a small crescentic anterior scar.

Remarks

The ornamentation of *Kangarina sola* is very distinctive and cannot be confused with any other known species. It bears some resemblance to an unnamed species illustrated by McKenzie (1974, pl. 3 (fig. 8)) and formally described by Whatley & Downing (1984) as *K. macropus*, from the Tertiary of southern Australia; however, *K. sola* can be distinguished by its intricate secondary ornamentation and its sun-pattern motif.

Distribution

This rare species was recorded at one site (TBD 344: 73 m) west of Cape Agulhas, and by Keeler (1981) at TBD 1259 (91 m) on the eastern Agulhas Bank.

Kangarina hendeyi sp. nov.

Fig. 51B-E

Derivation of name

This species is named for Dr Q. B. Hendey, Durban Natural Science Museum (formerly of the South African Museum), for his comradeship during collaborative studies on the Cenozoic sediments of the Western Cape.

Holotype

	length	height
MF-0726, LV, TBD 5254, 40 m	0,63	0,38

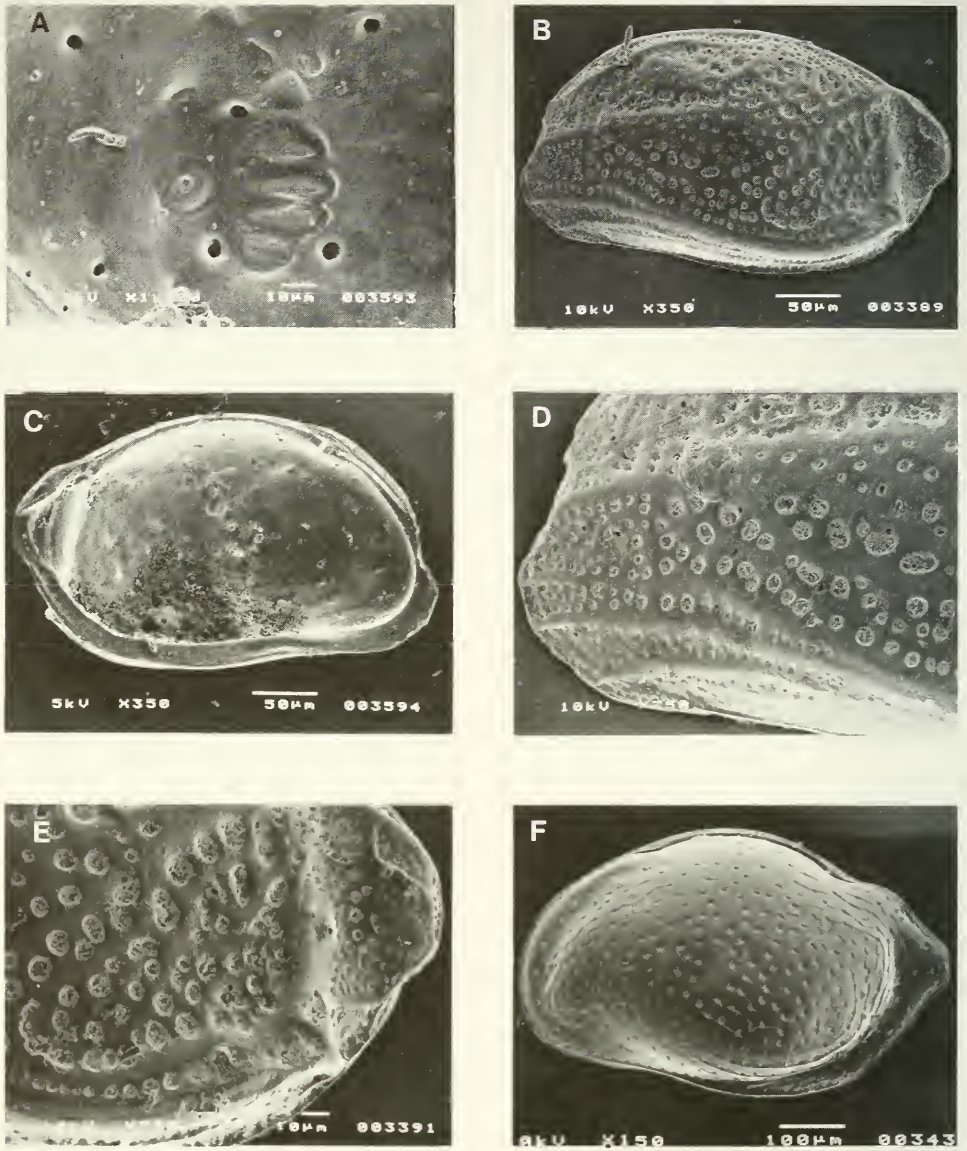


Fig. 51. A. *Kangarina sola* sp. nov., MF-0734, holotype, RV, TBD 344, 73 m, MS, SEM 3593. B-E. *Kangarina hendeyi* sp. nov., MF-0726, holotype, LV, TBD 5254, 40 m. B. SEM 3389. C. Internal view, SEM 3594. D. Detail of anterior area, SEM 3390. E. Detail of posterior area, SEM 3391. F. ?*Kangarina* sp. 3439, MF-0755, C, TBD 6846, 95 m, SEM 3439.
Scales: A, D-E = 10 μ , B-C = 50 μ , F = 100 μ .

Material

One valve.

Diagnosis

Species of *Kangarina* with a very broadly rounded DM, subdued, finely punctate ornamentation, and rounded, upturned caudal process.

Description

External features. Relatively elongate, somewhat ovate outline. AM broadly rounded, ventrally directed; PM rounded, with a blunt, upturned caudal process that is truncated and finely punctate at its tip. DM very broadly and evenly rounded; VM convex in posterior half and concave in anterior half. Overall, the ornamentation is subdued for the genus. A broad, poorly defined longitudinal median rib merges with a broad, flat central area that is connected to the posterodorsal corner by a sharper rib. The ventral part of the valve is quasi-alate, with a broad keel-like longitudinal ventral ridge. The valve surface is reticulate, with the coarsest pattern in the central area of the valve.

Internal features. Narrow MA, weak merodont hinge. MS not clearly seen, strong fulchral point.

Remarks

The elongate outline and subdued ornamentation of *Kangarina hendeyi* make this species distinctive. It is similar to a species illustrated from the Pliocene of the Dominican Republic by Van den Bold (1988) as '*Kangarina*' aff. '*K.*' *abyssicola* (Müller), but differs in possessing a less well-developed ventral keel, in having a less strongly arched DM, and in details of PM outline. Van den Bold (1988: 59) remarked that species such as these, with curved DM outlines probably belong in a new genus.

Hemicytherura sanmatiasensis Echevarria, 1988, from the Pliocene of Argentina, differs in VM outline, and in having coarser ornamentation. No similar species have been recorded from Australia, although the genus is well represented there.

Distribution

This rare species was recorded at one site (TBD 5254: 40 m) on the west side of False Bay.

Kangarina? sp. 3439

Fig. 51F

Illustrated material

	length	height
MF-0755, C, TBD 6846, 95 m	0,65	0,39

Material

Two valves.

Remarks

This globular species has a smooth surface ornamented with small punctae. Although its general outline is typical for the genus, the lack of characteristic ornamentation makes the generic assignment tentative.

Distribution

This rare species was recorded at site TBD 6846 (95 m) west of the Cape Peninsula.

Genus *Semicytherura* Wagner, 1957

Semicytherura clausi (Brady, 1880)

Fig. 52A–B

Cytherura clausi Brady, 1880: 134, pl. 32 (fig. 8a–d). Puri & Hulings, 1976: 303, pl. 21 (figs 9–10).
non *Cytherura clausi* Brady, 1880. Hornibrook, 1952: 51, pl. 15 (figs 242–244).

Illustrated material

	length	height
MF-0690, RV, TBD 5254. 40 m	0,44	0,22

Material

One valve.

Remarks

The outer surface of the single available valve is slightly abraded, but is conspecific with the lectotype illustrated by Puri & Hulings (1976). An internal view shows a very wide inner lamella, the posterior portion of which extends anteriorly as far as the MS, although these themselves were not clearly visible.

This species belongs to a closely related group within *Semicytherura* that is characterized by very similar external ornamentation and shell morphology, particularly the slightly bulbous posterior area. In addition to *S. clausi*, five species have been reported from the Southern Hemisphere: *Semicytherura* sp. 3379 (this study), also from False Bay; Keeler (1981: 65) recorded one species (as *Cytherura* aff. *C. clausi*) from the Agulhas Bank; Hartmann (1974) a further species (as ?*Hemicytherura kazmaierae*) from Lüderitz Bay; and *Semicytherura* aff. *S. costellata* (Brady, 1880) from Antarctic and Subantarctic localities (Benson 1964; Hartmann 1989, 1990). Neale's (1975) species *Semicytherura augusta* from the Santonian of Western Australia also belongs here, as does the species recorded as *Cytherura clausi* Brady by Hornibrook (1952) from the Lower Miocene to Recent of New Zealand.

Distribution

This rare species has been recorded only from False Bay—Brady's (1880) 'Challenger' site (15–20 fm), and TBD 5254 (40 m).

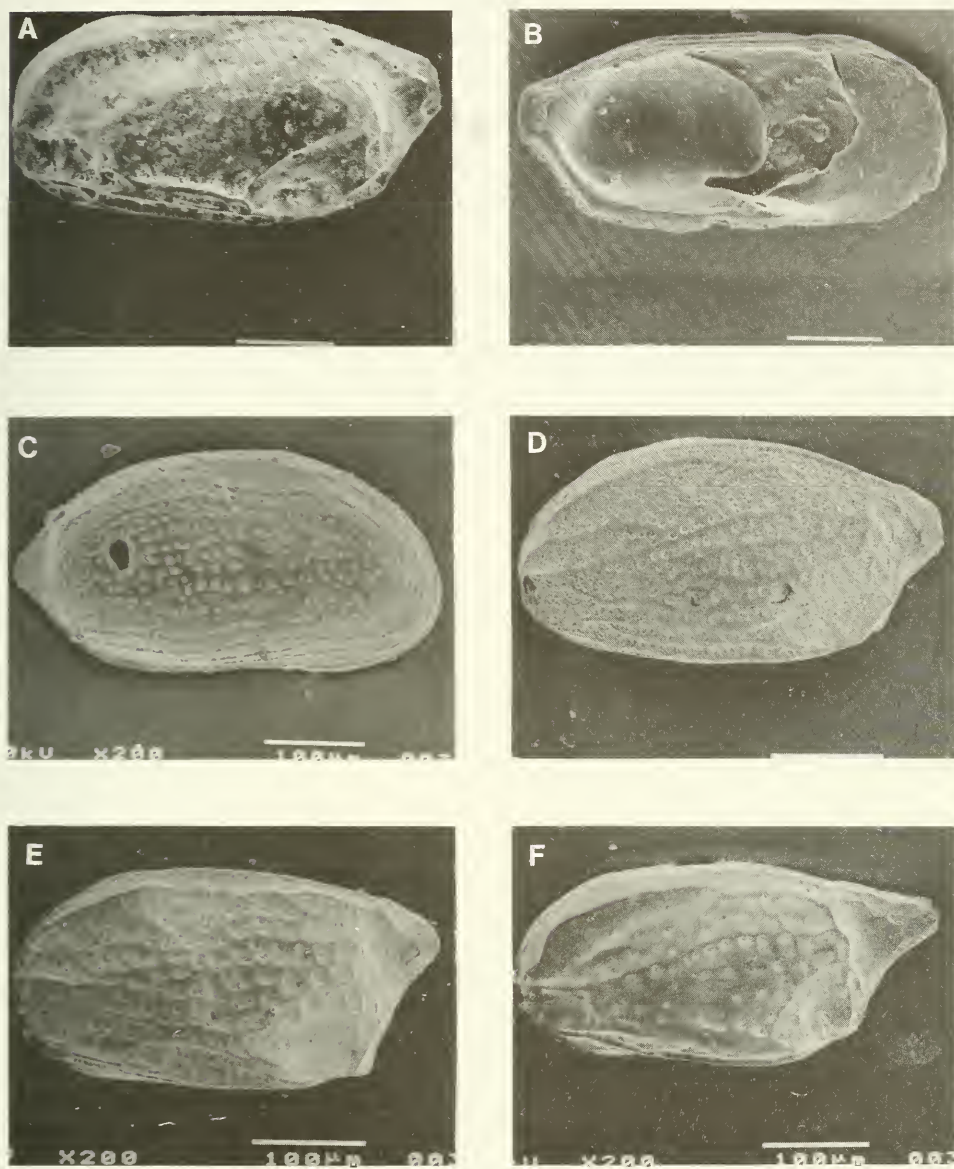


Fig. 52. A–B. *Semicytherura clausi* (Brady, 1880), MF-0690, LV, TBD 5254, 40 m. A. SEM 3208. B. Internal view, SEM 3216. C. *Semicytherura* sp. 3385, MF-0725, RV, TBD 5254, 40 m, SEM 3385. D. *Semicytherura* sp. 3382, MF-0724, LV, TBD 5254, 40 m, SEM 3382. E. *Semicytherura* sp. 3414, MF-0733, LV, TBD 344, 73 m, SEM 3414. F. *Semicytherura* sp. 3379, MF-0723, LV, TBD 5254, 40 m, SEM 3379. Scales: all 100 μ .

Semicytherura sp. 3379

Fig. 52F

Illustrated material

	length	height
MF-0723, LV, TBD 5254, 40 m	0,39	0,13

Material

One valve.

Remarks

This species is very similar to, but not conspecific with, *Semicytherura clausi* (Brady). It differs from Brady's species in the shape and ornamentation of the posteroventral bulge, which has an angular, concave surface. In addition, a narrow rib that runs from the posteroventral angle to the posterodorsal area is more or less straight in *Semicytherura* sp. 3379, but strongly curved and less complete in *S. clausi*. Clearly the two species are very closely related.

Distribution

A rare species was recorded only at site TBD 5254 (40 m) in False Bay.

Semicytherura sp. 3414

Fig. 52E

Semicytherura sp. Keeler, 1981: 76-77, pl. 3 (figs 19-20).

Illustrated material

	length	height
MF-0733, LV, TBD 344, 73 m	0,36	0,19

Material

Four valves.

Remarks

This species has an alate posteroventral projection, fine reticulation, and a small, sharp rib that runs parallel and close to the anterodorsal and dorsal margins. *Semicytherura* sp. 3414 is very similar to a species recorded by Van den Bold (1988) as *Cytherura* sp. C from the Mio-Pliocene of the Dominican Republic, from which it differs mainly in the shape of the posteroventral area. Its closest relative in local waters is *Semicytherura* sp. 3382 from False Bay.

Distribution

A rare species recorded from the inner shelf west of Cape Agulhas (TBD 344: 73 m) and from the eastern Agulhas Bank (TBD 1103: 64 m) (Keeler 1981).

Semicytherura sp. 3382

Fig. 52D

Illustrated material

	length	height
MF-0724, LV, TBD 5254, 40 m	0,37	0,18

Material

Four valves.

Remarks

This species is closest to *Semicytherura* sp. 3414, but differs in having a more ovate outline, a less well-developed posteroventral alation, and a finer rib and puncta ornamentation. It is very similar in outline and ornamentation to *S. rugosoreticulata* Whatley, Chadwick, Coxill & Toy, 1988, from the south-western Atlantic continental margin, but the latter has coarser ribs, particularly anteriorly.

Distribution

All modern specimens, recorded from site TBD 5254 in False Bay (40 m).

Semicytherura sp. 3385

Fig. 52C

Illustrated material

	length	height
MF-0725, RV, TBD 5254, 40 m	0,43	0,23

Material

Five valves.

Remarks

This plump, ovate species is ornamented with very fine longitudinal ribs, parallel to which are aligned fine punctae. A weak reticulation is developed in the posterior and anterior areas. *Semicytherura* sp. 3385 is similar in shape and ornamentation to *Cytherura arenicola* Hartmann, 1974, from the Benguela-Moçamedes coast of Angola. In Hartmann's species, the caudal process lies below mid-height and, overall, the valve outline is more elongate. In addition, the two differ in size and shape of the inner lamella.

Distribution

All modern specimens, recorded from site TBD 5254 in False Bay (40 m).

Genus *Hemicytherura* Elofson, 1941

Hemicytherura petheri sp. nov.

Fig. 53A-B

Cytherura sp. Keeler, 1981: 67-68, pl. 3 (figs 10-11).

Derivation of name

This species is named for J. Pether (South African Museum), for his work on the Neogene sediments of the coast of south-western Africa.

Holotype

	length	height
MF-0715, RV, TBD 1341, 53 m	0,40	0,22

Paratype

MF-0716, RV, TBD 344, 73 m	0,35	0,21
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Material

Three valves.

Diagnosis

Species of *Hemicytherura* with a bold longitudinal median ridge that posteroventrally forms a wide tear-shaped loop to rejoin itself anterior to mid-length.

Description

External features. Asymmetrically curved, finely scalloped AM, truncated PM with dorsally directed caudal process lying above mid-height. DM straight, VM straight, but partly obscured in lateral view by posteroventral overhang. Ornamentation consists of a few bold ridges, with deep, curved intercostal depressions. The main ridge is median, longitudinal, running from the AM to the posterior area, where it recurves ventrally in a wide loop, to rejoin itself just in front of mid-length. There is a further strong ridge subparallel to the DM, which is linked to the median ridge by a short, strong posterodorsal bar. Intercostal areas are finely punctate.

Internal features. Not clearly seen. Hinge is straight, robust, with prominent elongate TE and crenulate ME.

Remarks

The bold and distinctive ornamentation of *Hemicytherura petheri* cannot be confused with previously described species of the genus.

Distribution

This rare species was recovered from three inner-shelf sites: west of Cape Agulhas (TBD 1341: 53 m; and TBD 344: 73 m), and west of the Cape Peninsula (TBD 6824: 90 m). Keeler (1981) recorded it at one site on the eastern Agulhas Bank (TBD 1259: 91 m).

Hemicytherura sp. 3393

Fig. 53C

Illustrated material

	length	height
MF-0727, RV, TBD 5254, 40 m	0,33	0,18

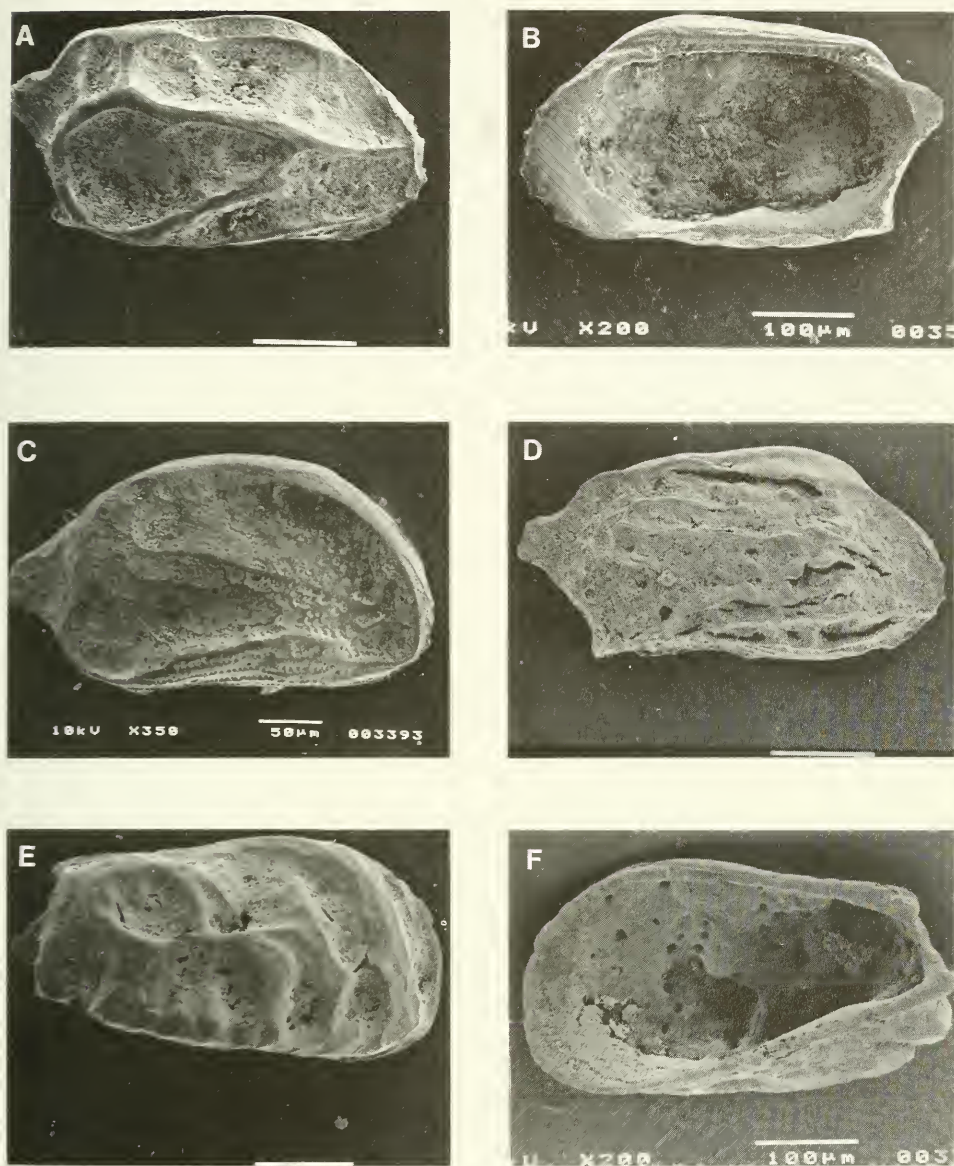


Fig. 53. A-B. *Hemicytherura petheri* sp. nov., MF-0715, holotype, RV, TBD 1341, 53 m. A. SEM 3325. B. Internal view, SEM 3599. C. *Hemicytherura* sp. 3393, MF-0727, RV, TBD 5254, 40 m, SEM 3393. D. ?*Hemicytherura* sp. 3404, MF-0730, RV, TBD 5254, 40 m, SEM 3404. E-F. *Paracytheridea* sp. 3339, MF-0722, RV, TBD 5254, 40 m. E. SEM 3339. F. Internal view, SEM 3519. Scales: A-B, D-F = 100 μ , C = 50 μ .

Material

One valve.

Remarks

The most prominent features of this species are the strongly compressed region adjacent to the AM, and the curved ventral ridge. No closely related species have been reported from the local geological record.

Distribution

This rare species was recorded only at site TBD 5254 in False Bay (40 m).

?Hemicytherura sp. 3404

Fig. 53D

Illustrated material

	length	height
MF-0730, RV, TBD 5254, 40 m	0,40	0,21

Material

One valve.

Remarks

The most prominent features of this species are celation along the dorsal margin, and the sharp posteroventral ala.

Distribution

This rare species was recorded only at site TBD 5254 in False Bay (40 m).

Genus *Paracytheridea* Müller, 1894

Paracytheridea sp. 3339

Fig. 53E-F

Illustrated material

	length	height
MF-0722, RV, TBD 5254, 40 m	0,42	0,21

Material

One valve.

Remarks

This small, very compressed species is characterized by coarse, deeply incised lateral ridges. The RV hinge consists of an ATE with three lobes, a crenulate ME groove, and a short quadrate PTE. Hartmann (1974) described one species of the genus from

Angola (*Paracytheridea luandensis*), but this has distinct alation and a prominent caudal process.

Distribution

This rare species was recorded relict only at one site (TBD 5254: 40 m) in False Bay.

Family Hemicysteridae Puri, 1953

The revision by Whatley *et al.* (1987) of various hemicysterid taxa from the south-western Atlantic area allows a taxonomic reassignment of some previously described species from the south-eastern Atlantic.

Thirty species in 11 hemicysterid genera have been recorded from Quaternary marine sediments around southern and south-western Africa (Table 3). All 11 genera and 26 of these species extend into the present area of interest, although only 18 species in 10 genera are found on the continental shelf (in contrast to the coastal and inshore zone).

TABLE 3

Species of the family Hemicysteridae recorded from around southern Africa.

<i>Ambostracon levezovi</i> (Klie, 1940), coastal to inner shelf, Lüderitz–St Helena Bay
<i>Ambostracon flabellucostata</i> (Brady, 1880), shelf, Walvis Ridge–Knysna
<i>Ambostracon keeleri</i> Dingle, 1992, shelf, Walvis Ridge–Knysna
<i>Ambostracon</i> sp. 3553, mid-Orange shelf
<i>Ambostracon</i> sp. 3571, mid-Orange shelf
<i>Ambostracon</i> (<i>Patagonacythere</i>) sp. 3556, mid-outer Orange–Namaqualand shelf
<i>Aurila dayii</i> Benson & Maddocks, 1964, coastal, Lüderitz–Knysna
<i>Aurila kliei</i> Hartmann, 1974, coastal to mid-shelf, Lüderitz–Knysna
<i>Austroaurila rugosa</i> sp. nov., inner to mid-shelf Orange River–Knysna
<i>Caudites knysnaensis</i> Hartmann, 1974, coastal, Knysna
<i>Caudites dacunhai</i> Hartmann, 1974, coastal, Mozambique
<i>Caudites algicola</i> Hartmann, 1974, coastal, Natal–Mozambique
<i>Caudites</i> sp. 3329, inner shelf, Saldanha Bay
<i>Coquimba birchi</i> sp. nov., inner to mid-shelf, south-western Cape
? <i>Falklandia</i> sp. 3546, inshore to inner shelf, Cape Peninsula–Knysna
<i>Meridionalicythere petricola</i> (Hartmann, 1974), inner shelf, Lüderitz–Knysna
<i>Meridionalicythere foveata</i> (Hartmann, 1974), Knysna
<i>Meridionalicythere</i> sp. 3581, outer Namaqualand shelf
<i>Mutilus bensonmaddocksorum</i> Hartmann, 1974, coastal to nearshore, Lüderitz–Knysna
<i>Mutilus spendideornatus</i> Hartmann, 1974, coastal, Mozambique
<i>Mutilus malloryi</i> sp. nov. inner shelf, Cape Peninsula
<i>Procythereis major</i> Klie, 1940, coastal, Lüderitz
<i>Procythereis minor</i> Klie, 1940, coastal, Lüderitz–Kommetje
<i>Procythereis serrata</i> Klie, 1940, coastal, Lüderitz
? <i>Quadracythere</i> sp. 3333, inner to mid-shelf, Orange River–south-western Cape
<i>Urocythereis arcana</i> sp. nov., shelf, Walvis Ridge–Knysna
? <i>Urocythereis</i> sp. 3310, nearshore, Hout Bay
? <i>Urocythereis</i> sp. 3570, outer shelf, Walvis Bay
? <i>Urocythereis</i> sp. 3472, shelf, False Bay–Agulhas Bank
? <i>Urocythereis</i> sp. 3567, outer shelf, Walvis Bay–Agulhas Bank

Genus *Ambostracon* Hazel, 1962

Subgenus *Ambostracon* (*Ambostracon*) Hazel, 1962

Ambostracon (*Ambostracon*) sp. 3553

Fig. 54A

Illustrated material

	length	height
MF-0777, RV, TBD 2736, 205 m	0,70	0,40

Material

One valve.

Remarks

This species is very close to *A. (A.) flabellcostata* (Brady) and *Ambostracon* (*A.*) sp. 3571, but differs in the coarseness of the ornamentation and the disposition of ribs along the dorsolateral area.

Distribution

This rare species was recorded relict at site TBD 2736 (205 m) on the mid-Orange shelf.

Ambostracon (*Ambostracon*) sp. 3571

Fig. 54B

Illustrated material

	length	height
MF-0786, C, TBD 2485, 227 m	0,66	0,37

Material

Two valves.

Remarks

This species is very close to *A. (A.) flabellcostata* (Brady) and *Ambostracon* (*A.*) sp. 3553. It differs from the latter principally in the relative fineness of its ornamentation, and from the former in the straightness of the ocular ridge (this is curved sub-parallel to the AM in *A. (A.) flabellcostata*). There is also an additional short curved rib immediately post-adjacent to the ocular ridge in *Ambostracon* (*A.*) sp. 3571.

Distribution

This rare species was recorded relict at site TBD 2485 (227 m) on the mid-Orange-Namaqualand shelf.

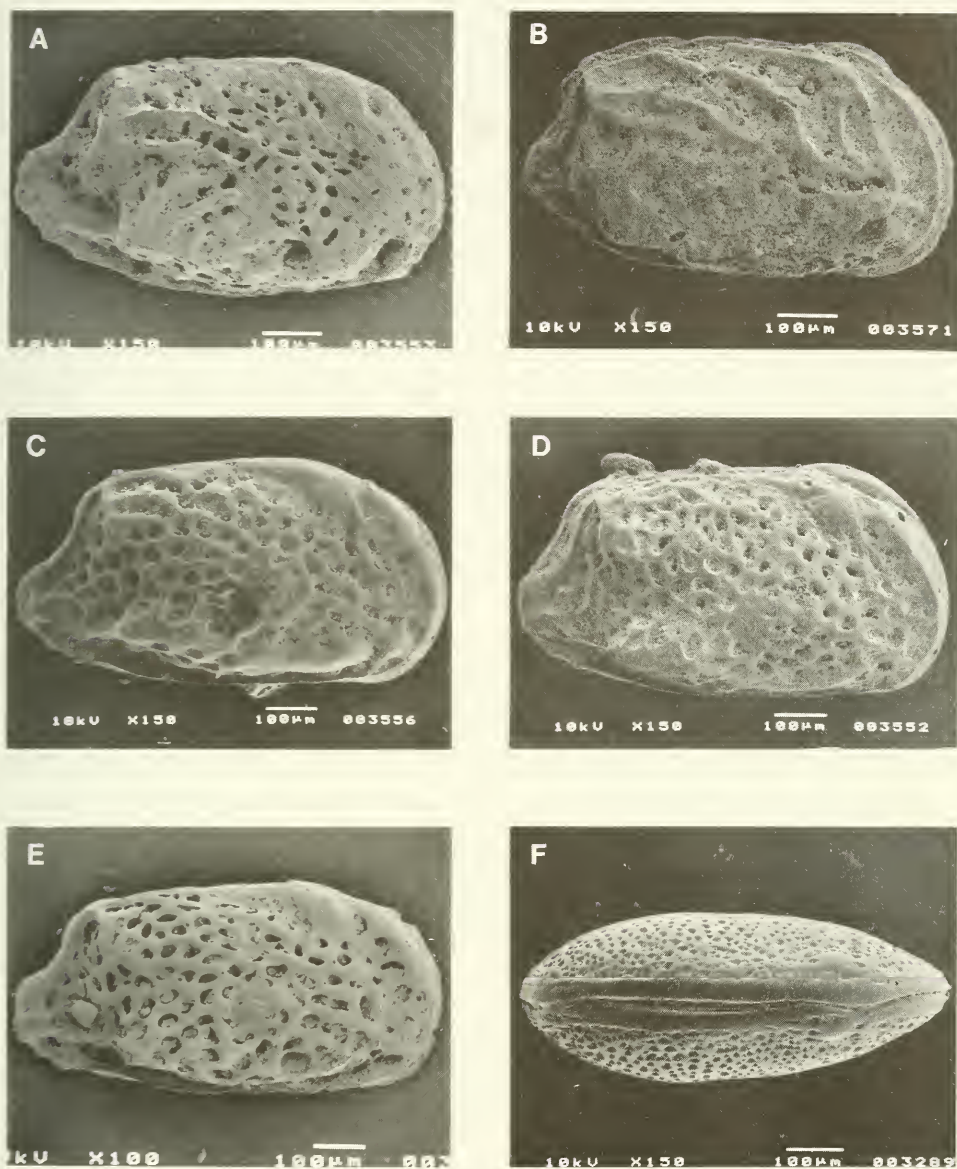


Fig. 54. A. *Ambostracon (Ambostracon)* sp. 3553, MF-0777, RV, TBD 2736, 205 m, SEM 3553. B. *Ambostracon (Ambostracon)* sp. 3571, MF-0786, C, TBD 2485, 227 m, right view, SEM 3571. C-E. *Ambostracon (Patagonacythere)* sp. 3556. C. MF-0778, RV, TBD 2719, 240 m, SEM 3556. D. MF-0776, C, TBD 2369, 188 m, right view, SEM 3552. E. MF-0779, RV, TBD 2361, 241 m, SEM 3557. F. *Aurila kliei* Hartmann, 1974, MF-0646, C, TBD 6822, 42 m, SEM 3289. Scales: all 100 μ m.

Subgenus *Ambostracon* (*Patagonacythere*) Hartmann, 1962*Ambostracon* (*Patagonacythere*) sp. 3556

Fig. 54C-E

Illustrated material

	length	height
MF-0778, RV, TBD 2719, 240 m	0,80	0,40
MF-0776, C, TBD 2369, 188 m	0,77	0,40
MF-0779, RV, TBD 2361, 241 m	0,78	0,39

Material

Fourteen valves.

Remarks

This species is characterized by posteriorly directed elevations in the postero-dorsal and posteroventral areas. The latter continues anteriorly as a ridge that terminates before reaching the AM. The eye and SCT are well developed, and ornamentation is strongly reticulate. Outline and ornamentation are reminiscent of *Ambostracon* (*A.*) *flabellcostata* (Brady), but the species lacks an ocular ridge and consequently belongs in *A.* (*Patagonacythere*).

Distribution

This species was recovered from seven sites in a relatively small area on the mid to outer Orange-Namaqualand shelf, with UDL and LDL of 188 m and 265 m, respectively. The poor state of preservation suggests that some of the specimens have been reworked.

Genus *Aurila* Pokorný, 1955

In addition to the two modern species of *Aurila* from southern and south-western Africa (Table 3), Van den Bold (1966) recorded *A. punctata* (von Münster, 1830) from the Mio-Pliocene of Gabon.

Aurila kliei Hartmann, 1974

Figs 54F, 55A-D, 56A

Hemicythere? sp. Benson & Maddocks, 1964: 27-29, pl. 5 (figs 3-4, 6, 8-9), text-fig. 16.*Aurila kliei* Hartmann, 1974: 286-288, pl. 54 (figs 402-411), pl. 55 (figs 412-416), pl. 149 (fig. 10).*Illustrated material*

	length	height
MF-0646, LV, TBD 6822, 42 m	0,73	0,40
MF-0647, RV, TBD 6821, 15 m	0,64	0,38
MF-0649, LV, TBD 6821, 15 m	0,68	0,39

Material

44 valves.

Remarks

Benson & Maddocks (1964) recognized two varieties of the species that they allocated to *Hemicythere?* sp.: a larger punctate form and a smaller, more coarsely ornamented form. I suspect that these represent adults and juveniles, since in my material the more coarsely ornamented specimens are juveniles.

Distribution

Hartmann (1974) recorded *Aurila kliei* from Lüderitz Bay and Kommetjie (Cape Peninsula), and suggested that it was a cold-water species confined to the west coast. However, Benson & Maddocks (1964) had previously noted it at Leisure Island in Knysna Lagoon, on the south coast.

Aurila kliei occurs offshore in two areas—immediately north of Lüderitz, and between Saldanha Bay and Cape Point (Fig. 57).

Modern specimens were collected only off the south-western Cape with UDL and LDL of 15 m and 58 m, respectively. Two of these sites are in the vicinity of Hout Bay (TBD 6821 and 6822), close to Hartmann's (1974) coastal site at Kommetjie.

The relict fauna is more widely dispersed. Off Lüderitz, UDL and LDL are 31 m and 51 m, respectively, whereas off the Cape Peninsula the UDL is 15 m (Hout Bay) and the LDL is 160 m. The latter value is based on a single, abraded valve that might be allochthonous, in which case the LDL is 90 m.

Genus *Austroaurila* Whatley, Chadwick, Coxill & Toy, 1987

This genus was originally described from the southern part of South America (Chile and Argentina) and from the Falkland Islands (Whatley *et al.* 1987), where it had been recorded under various names by Brady (1880), Skogsberg (1928), Hartmann (1962), Rossi de Garcia (1970), and Kaesler *et al.* (1979). Three species are known from this area, and all occur in littoral or mid-shelf habitats (to 150 m) (Whatley *et al.* 1987).

Austroaurila rugosa sp. nov.

Figs 55E–F, 56B, 58A–C

Nereina? sp. B Benson & Maddocks, 1964: 30–31, pl. 5 (figs 13–14), text-fig. 18.
Species 75 Boomer, 1985, text-fig. 5.

Derivation of name

Rugosa—Latin, rough, uneven; reference to lateral surface ornamentation.

Holotype

	length	height
MF-0650, C, TBD 6835, 100 m	0,60	0,41

Paratypes

	length	height
MF-0651, LV, TBD 2975, 180 m	0,60	0,39
MF-0652, LV, TBD 6822, 42 m	0,62	0,40
MF-0653, RV, TBD 2975, 180 m	0,60	0,37
MF-0655, LV, juv. TBD 2975, 180 m	0,52	0,32

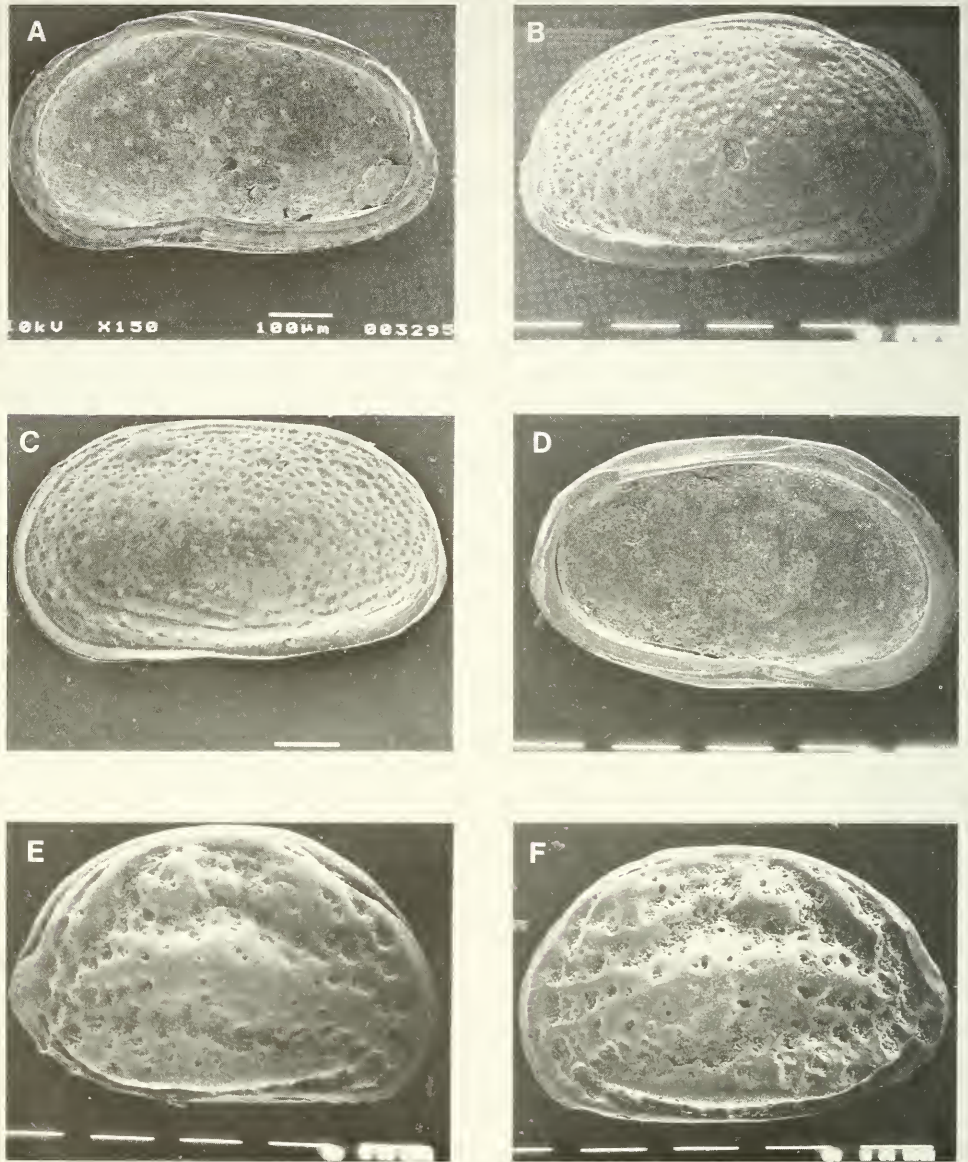


Fig. 55. A–D. *Aurila kliei* Hartmann, 1974. TBD 6821, 15 m. A–B. MF-0647, RV. A. Internal view, SEM 3295. B. SEM 3035. C–D. MF-0649, LV. C. SEM 3293. D. Internal view, SEM 2993. E–F. *Austroaurila rugosa* sp. nov. E. MF-0650, holotype, C, TBD 6835, 100 m, right view, SEM 2994. F. MF-0651, paratype, LV, TBD 2975, 180 m, SEM 3038. Scales: all 100 μ .

Material

90 valves.

Diagnosis

Species of *Austroaurila* with a thick longitudinal median ridge and two large, rounded tubercles on the dorsal part of the lateral surface, the anterior of which incorporates the eye spot.

Description

External features. Heavily calcified, with a rough, coarsely-hewn appearance. Ovate (RV) to sub-quadrate (LV) in lateral outline. AM broadly and asymmetrically rounded, PM sub-caudate, slightly upturned in RV. DM strongly convex in RV, straighter in LV. VM almost straight, but partly obscured by ventrolateral overhang. Ornamentation is dominated by a massive longitudinal ridge that crosses a wide prominent SCT. It has a tendency, both anteriorly and posteriorly, to split into three narrow ribs, which anteriorly extend to the AM. There is a thick, curved ventrolateral keel and a short prominent



Fig. 56. A. Muscle scars of *Aurila kliei* Hartmann, 1974, MF-0648, RV, TBD 6821, 15 m, internal view. B. Muscle scars of *Austroaurila rugosa* sp. nov., MF-0654, LV, TBD 2975, 180 m, internal view.

Scales: 100 μ .

inclined posterodorsal rib that narrows and runs along the DM to the eye spot. The latter feature is incorporated in a large rough tubercle. A second, more prominent tubercle lies just behind mid-length, immediately below the DM rib. These two elevations lie either side of the SCT. Intercoastal areas are coarsely reticulate.

Internal features. MA relatively narrow with 20–25 fine hair-like RPC anteriorly. The hinge is robust, holamphidont, with a small swelling at the posterior end of the ME. The terminal elements are particularly large, with only a slight auriline notch in the PTE. MS consist of three anterior scars and four adductors.

Remarks

Austroaurila rugosa was first recorded by Benson & Maddocks (1964) from Leisure Island, Knysna Lagoon. The RPC were reported as simple and not numerous. This conflicts with my assessment but, from the external morphology of this distinctive species, there is no doubt that we are both dealing with the same taxon.

No other species of the genus occurs off southern Africa. Comparing the African material with that illustrated by Whatley *et al.* (1987), the closest of the South American species is *A. recurvirostrata* (Skogsberg, 1928). The two species differ in the possession by *A. rugosa* of the massive median ridge, but are similar in overall shape and the

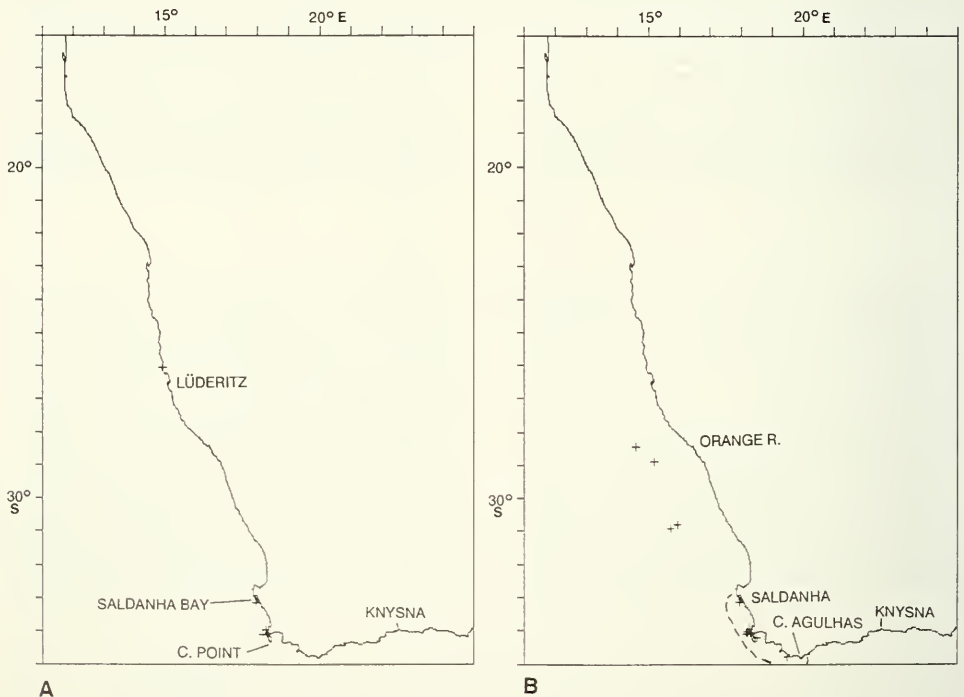


Fig. 57. Distribution on the continental margin of *Aurila kliei* Hartmann, 1974 (A) and *Austroaurila rugosa* sp. nov. (B). A. Hartmann's (1974) specimens were collected from sites at Lüderitz Bay and Kommetjie (just north of Cape Point, on the Atlantic side of the Cape Peninsula). Benson & Maddocks (1964) recorded the species from Knysna Lagoon. B. The dashed line encloses modern sites. Benson & Maddocks (1964) first recorded the species from Knysna Lagoon.

somewhat tumid appearance of *A. recurvirostrata*. Of the three species noted by Whatley *et al.* (1987) from the south-western Atlantic, *A. recurvirostrata* has the deepest water habitat. Skogsberg (1928) recovered it at 137–150 m on Burwood Bank, south of the Falkland Islands.

Distribution

Austroaurila rugosa sp. nov. is a relatively rare species (mean = 2,3% in samples in which it occurs) that is restricted to latitudes south of 28°S (Orange shelf to Knysna Lagoon—Fig. 57).

Modern shelf populations occur only off the south-western Cape and have UDL and LDL 15 m and 90 m, respectively.

Relict faunas are more extensive, with UDL and LDL of 80 m and 205 m, respectively, extending to a small suite of sites on the Orange shelf.

Genus *Meridionalicythere* Whatley, Chadwick, Coxill & Toy, 1987

Meridionalicythere petricola (Hartmann, 1974)

Figs 58D–F, 59A

Aurila petricola Hartmann, 1974: 285–286, pl. 56 (figs 417–427), pl. 57 (figs 428–432), pl. 149 (fig. 8).

Illustrated material

	length	height
MF-0711, RV, TBD 6822, 42 m	0,62	0,35
MF-0712, LV, TBD 6822, 42 m	0,62	0,35
MF-0718, C, TBD 2224, 58 m	0,75	0,39

Material

Thirteen valves.

Remarks

This species was originally referred to *Aurila* by Hartmann (1974) but its valve outline is atypical for the genus. Whatley *et al.*'s (1987) subsequent erection of *Meridionalicythere* for species in the south-western Atlantic allows a more satisfactory allocation. Ornamentation in the posterior part of the valves is somewhat bolder than in Hartmann's (1974) original illustrations, but otherwise the specimens from the inshore and coastal areas are the same.

Distribution

Hartmann (1974) recorded *M. petricola* from rocky coastal substrates between Lüderitz and Knysna. In the present survey, this geographical range has not been extended (Fig. 60) but the species has been shown to have a depth range of 15 m to 58 m.

Modern specimens were recovered from the sites off the south-western Cape, whereas a relict assemblage occurs at TBD 3265, inshore just north of Lüderitz (31 m).

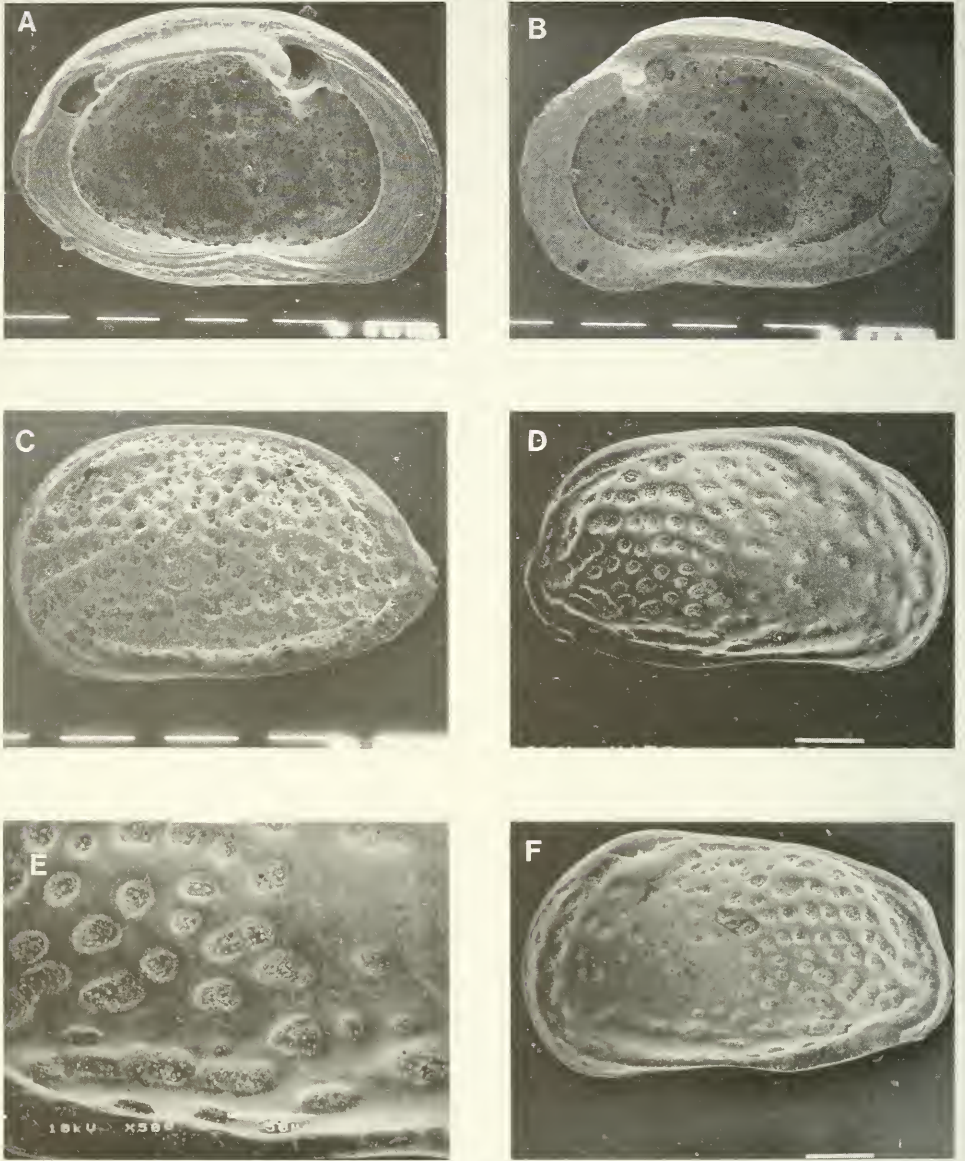


Fig. 58. A–C. *Austroaurila rugosa* sp. nov. A. MF-0652, paratype, LV, TBD 6822, 42 m, SEM 2986. B. MF-0653, RV, TBD 2975, 180 m, internal view, SEM 3040. C. MF-0655, LV, TBD 2975, 180 m, juvenile, SEM 2997. D–F. *Meridionalicythere petricola* (Hartmann, 1974), TBD 6822, 42 m. D–E. MF-0711, RV, D. SEM 3312. E. Detail of posteroventral area, SEM 3314. F. MF-0712, LV, SEM 3316. Scales: A–D, F = 100 μ , E = 50 μ .

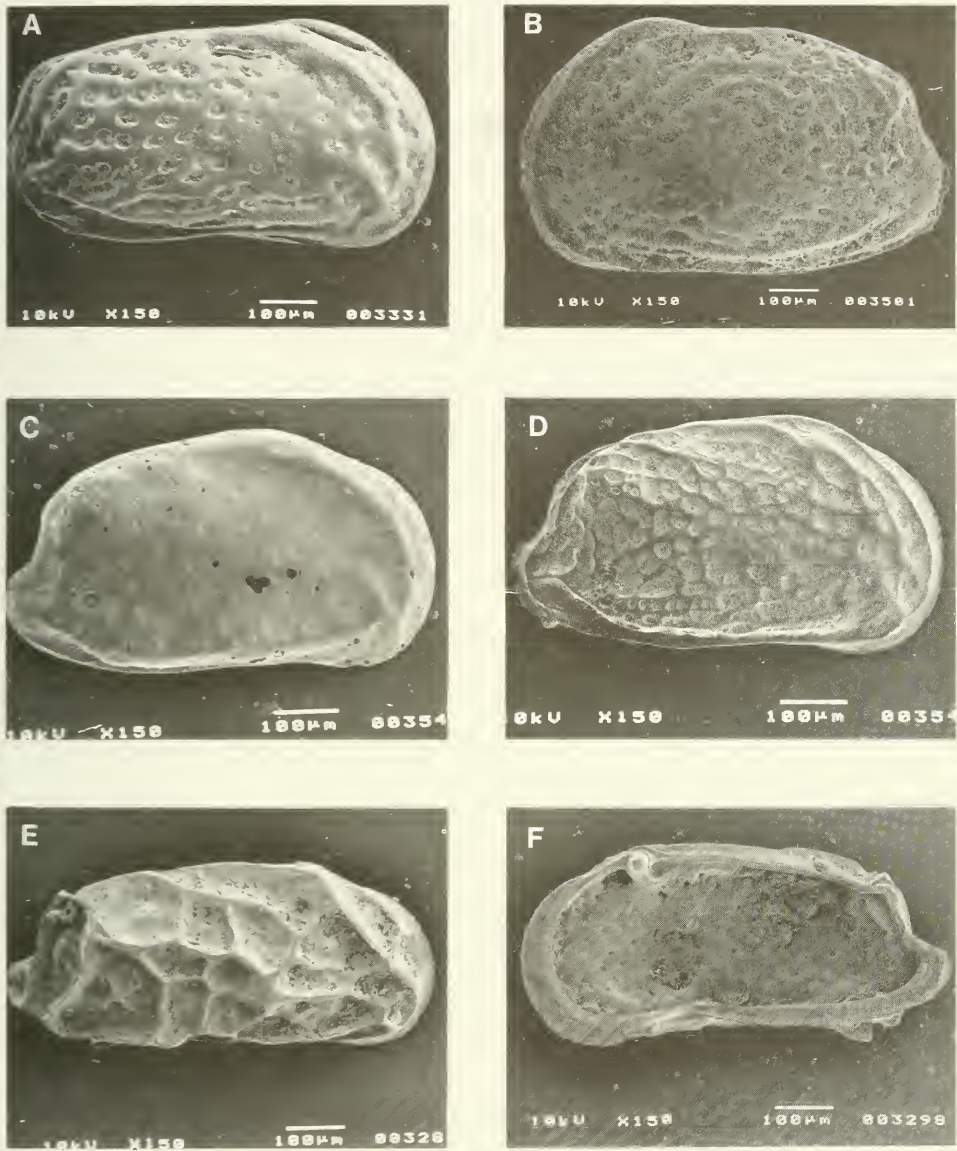


Fig. 59. A. *Meridionalicythere petricola* (Hartmann, 1974), MF-0718, C, TBD 2224, 58 m, SEM 3331. B. ?*Meridionalicythere* sp. 3581, MF-0791, C, TBD 2361, 241 m, SEM 3581. C-D. ?*Falklandia* sp. 3546, TBD 6847, 94 m. C. MF-0752, RV, SEM 3546. D. MF-0753, RV, SEM 3547. E-F. *Mutilus bensonmaddocksorum* Hartmann, 1974, MF-0706, RV, TBD 6821, 15 m. E. SEM 3284. F. Internal view, SEM 3298. Scales: all 100 μ .

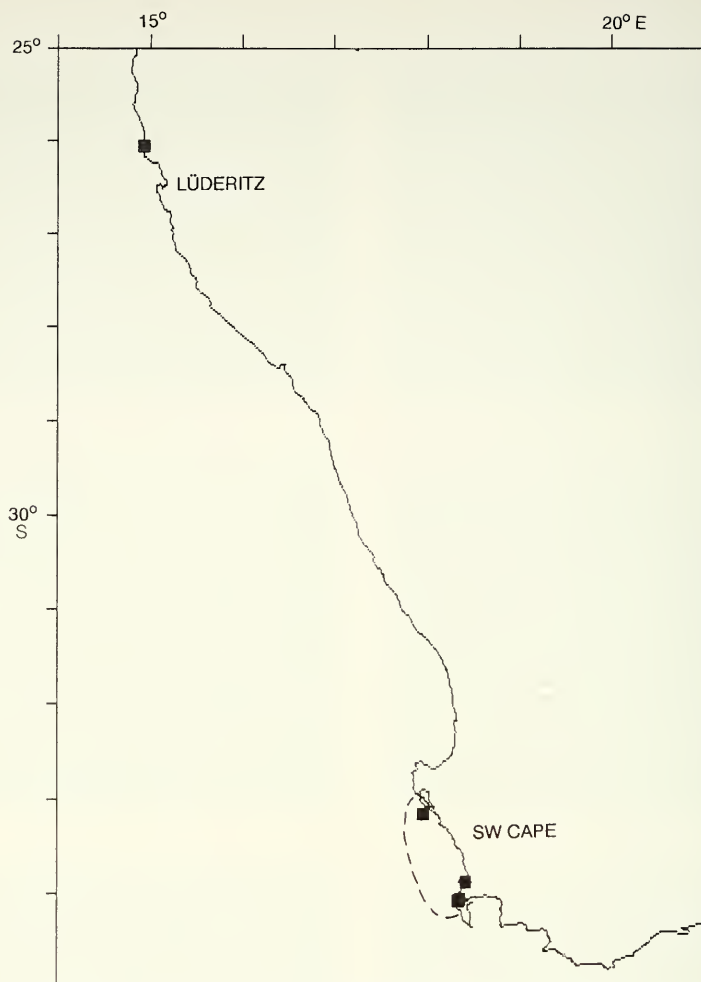


Fig. 60. Distribution of *Meridionalicythere petricola* (Hartmann, 1974) on the continental margin off south-western Africa. Modern sites are enclosed by the dashed line.

?*Meridionalicythere* sp. 3581

Fig. 59B

Illustrated material

MF-0791, C, TBD 2361, 241 m	length	height
	0,83	0,50

Material

Four valves.

Remarks

Two poorly preserved carapaces of a species characterized by a prominent ventro-lateral keel and a small, triangular posterodorsal protuberance.

Distribution

This species was recorded only at site TBD 2361 (241 m) on the outer Namaqualand shelf.

Genus *Falklandia* Whatley, Chadwick, Coxill & Toy, 1987

?*Falklandia* sp. 3546

Fig. 59C–D

Nereina? sp. A Benson & Maddocks, 1964: 29–30, pl. 5 (figs 1–2, 5, 7), text-fig. 17.

Illustrated material

	length	height
MF-0752, RV, TBD 6847, 94 m	0,65	0,35
MF-0753, RV, TBD 6847, 94 m	0,64	0,34

Material

Two valves.

Remarks

This species is provisionally placed in *Falklandia*. Celation is well developed in some specimens, including all those illustrated by Benson & Maddocks (1964), and gives rise to a smooth lateral surface, in contrast to the well-developed ribs and reticulation of one specimen (Fig. 59D).

Distribution

This species was recorded only at site TBD 6847 (94 m), west of the Cape Peninsula (relict and modern). Benson & Maddocks (1964) recovered five relict specimens from Leisure Island in Knysna Lagoon.

Genus *Mutilus* Neviani, 1928

Mutilus bensonmaddocksorum Hartmann, 1974

Figs 59E–F, 61A–B

Mutilus sp. Benson & Maddocks, 1964: 34–35, pl. 6 (figs 7–11), text-fig. 21.

Mutilus bensonmaddocksorum Hartmann, 1974: 280–281, pl. 48 (figs 365–374).

Illustrated material

	length	height
MF-0706, RV, TBD 6821, 15 m	0,72	0,31
MF-0707, LV, TBD 6821, 15 m	0,66	0,33

Material

Two valves.

Remarks

One valve is identical to the material illustrated by Benson & Maddocks (1964) and Hartmann (1974), but the other (Fig. 59E–F) is considerably more elongate and does not have the high anterodorsal outline of the male LV shown by Hartmann, although it has the same ornamentation. I assume this is a male RV, which previously has not been illustrated.

Distribution

Hartmann (1974) recorded *M. bensonmaddocksorum* from a coastal site at Lüderitz, as well as from Knysna Lagoon, where Benson & Maddocks (1964) found it at Leisure Island. In the present survey, this rare species was recovered from one site in Hout Bay (TBD 6821: 15 m, modern and relict).

Mutilus bensonmaddocksorum is a coastal and nearshore species, in contrast to *M. malloryi* sp. nov., which occurs in slightly deeper inshore areas.

Mutilus malloryi sp. nov.

Fig. 61C–F, 62A, 63E

Derivation of name

This species is named for Emeritus Professor John Mallory, who, as Professor of Oceanography at the University of Cape Town, played a leading role in encouraging early marine geological activities on the southern African continental shelf.

Holotype

	length	height
MF-0703, RV, TBD 6824, 90 m	0.55	0.30

Paratypes

	length	height
MF-0702, LV, TBD 6824, 90 m	0.56	0.30
MF-0704, LV, TBD 6824, 90 m	0.57	0.32
MF-0705, RV, TBD 6824, 90 m	0.54	0.31

Material

Seventeen valves.

Diagnosis

Species of *Mutilus* with a prominent rib that runs sub-parallel to the AM, from the eye spot to the anteroventral corner.

Description

External features. A strongly ornamented species with a sub-quadrated lateral outline. RV and LV differ considerably in shape. Broadly rounded AM, somewhat angular

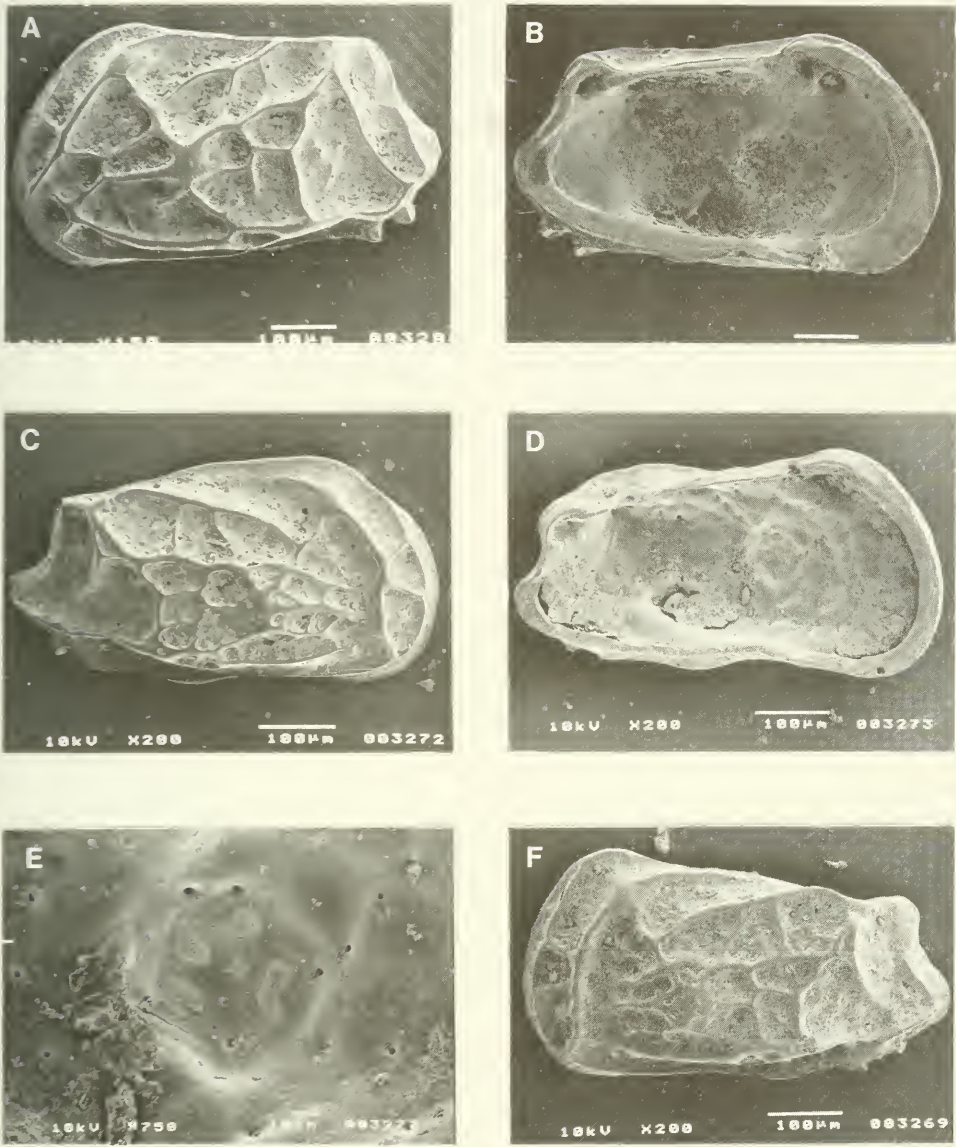


Fig. 61. A-B. *Mutilus bensonmaddocksorum* Hartmann, 1974, MF-0707, LV, TBD 6821, 15 m. A. SEM 3286. B. Internal view, SEM 3302. C-F. *Mutilus malloryi* sp. nov. TBD 6824, 90 m. C. MF-0703, holotype, RV, SEM 3272. D-E. MF-0704, paratype, LV. D. Internal view, SEM 3273. E. MS. SEM 3277. F. MF-0702, paratype, LV, SEM 3269. Scales: A-D, F = 100 µ, E = 10 µ.

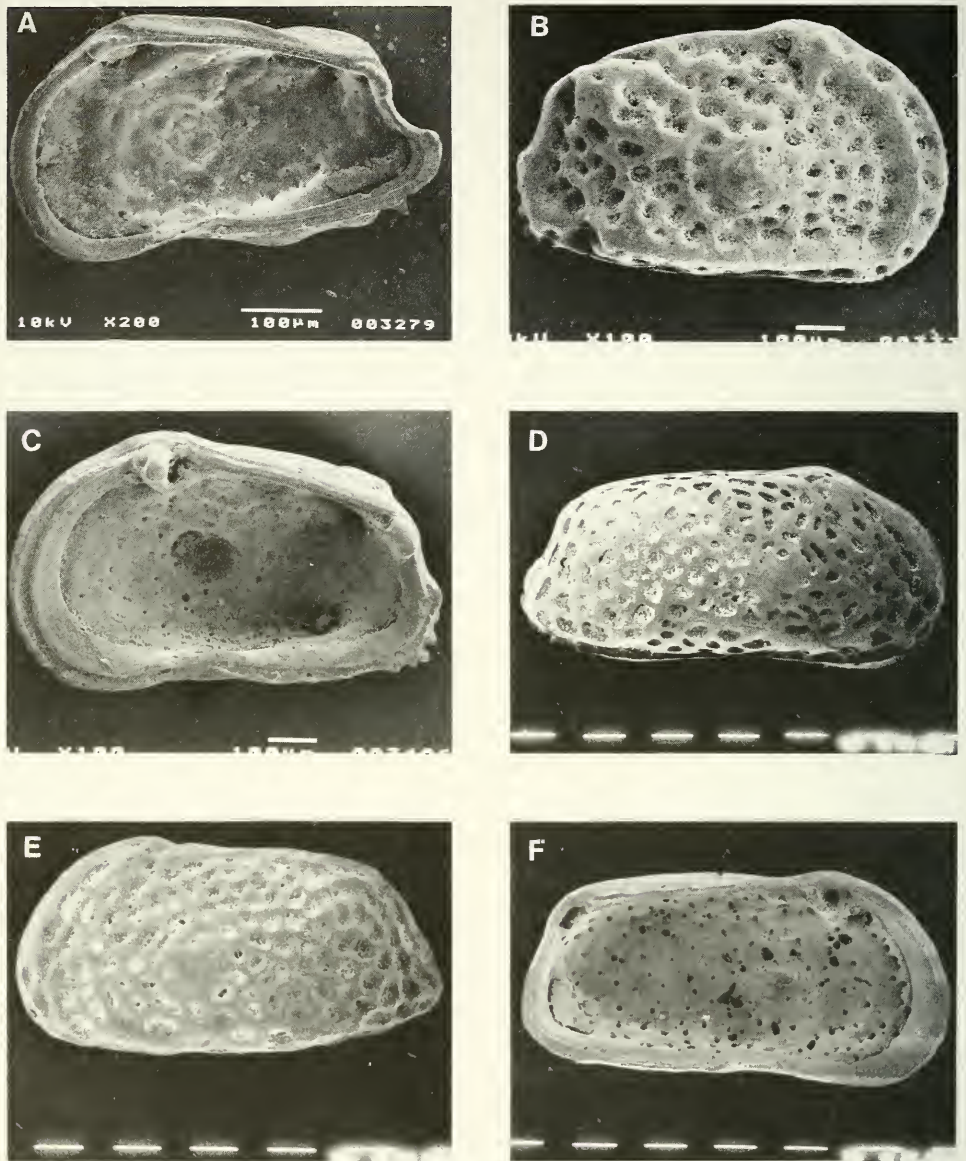


Fig. 62. A. *Mutilus mallorvi* sp. nov., MF-0705, paratype, RV, TBD 6824, 90 m, SEM 3279. B-C. *?Quadracythere* sp. 3333, MF-0719, RV, TBD 6835, 100 m. B. SEM 3333. C. Internal view, SEM 3496. D-F. *Urocythereis arcana* sp. nov. D. MF-0656, holotype, RV, TBD 6836, 80 m, SEM 2861. E. MF-0657, paratype, LV, TBD 6836, 80 m, SEM 2863. F. MF-0658, paratype, LV, TBD 2973, 173 m, internal view, SEM 2857. Scales: all 100 μ .

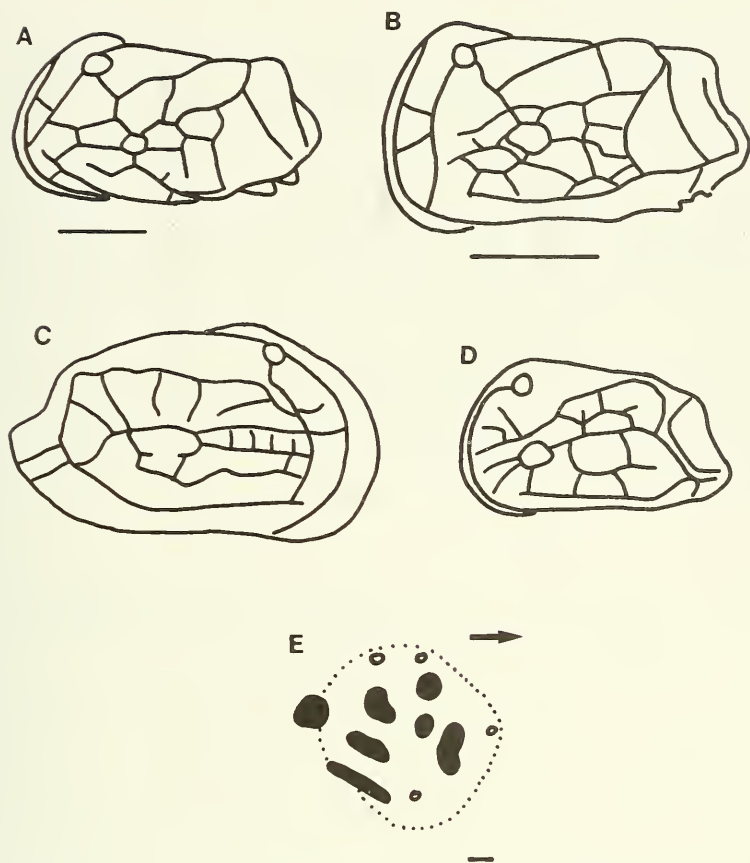


Fig. 63. A–D. Sketches of ornamentation of possibly related species of *Mutilus*. A. *M. bensonmaddockorum* Hartmann, 1974, MF-0707, LV, TBD 6821, 15 m. B. *M. malloryi* sp. nov. MF-0702, paratype, LV, TBD 6824, 90 m. C. *M. splendidornatus* Hartmann, 1974 (pl. 150 (fig. 9)—Mozambique). D. *M. pumila* (Brady, 1866) (from Hartmann 1979, pl. 6 (fig. 8)—Australia). E. MS of *Mutilus malloryi* sp. nov. holotype, MF-0703, RV, TBD 6824, 90 m, SEM 3277. Open features are normal pores, and the dotted line marks the limit of the sub-central depression. Scales: A–D = 100 μ , E = 10 μ .

anteroventrally: LV radius of curvature is broader than RV. PM caudate, upturned dorsally. DM in RV straight, concave in LV with prominent anterior hinge ear. VM sinuous, with two prominent, small, stubby posteroventral spines. There is a prominent postero-dorsal elevation that marks the convergence of four ribs. Overall, the valve surface is coarsely reticulate with numerous sharply defined ribs. The main ribs are: sub-parallel to the AM from the eye spot to the anteroventral corner; sub-parallel to the VM from the caudal process to the anteroventral corner; along the DM; and four ribs that emanate from the postero-dorsal process. In the latter category, ribs lie below the DM, terminating posterior to the eye spot; along the DM to the posterior hinge ear; in a sweeping curve towards the posteroventral margin; in a longitudinal median position that dorsally skirts a sub-central knot of ribs.

Internal features. Hinge hemimerodont, with relatively small TE in RV. MA narrow, no details of which were clearly seen. MS not clear but, in the holotype, they consist of a cluster of five rounded scars set in a depression, with at least two further scars posteriorly on the periphery of the depression (Fig. 63E).

Remarks

Mutilus malloryi differs from *M. bensommaddockorum* in having a more broadly rounded AM and overall less elongate outline. There are also differences in details of rib patterns, the most obvious of which are along the AM (see Fig. 63), and the three sub-parallel ribs that project anteriorly from the SCT of *M. bensommaddockorum*.

A related species from Mozambique (*M. splendidornatus* Hartmann, 1974) differs from *M. malloryi* in possessing a rib that follows a continuous sweeping line from the SCT, via the posterodorsal process to the VM and almost to the AM rib.

A similarly ornamented species, *M. pumila* (Brady, 1866), is widely recorded from coastal locations in southern Australia (e.g. McKenzie 1967; Hartmann 1979). This differs from the three southern African species by lacking an ocular rib in the AM area.

Distribution

Mutilus malloryi was recovered from only two sites south-west of Hout Bay. Site TBD 6822 (42 m) contained one modern valve, and site TBD 6824 (90 m) had a larger population of relict valves.

Genus *Quadracythere* Hornibrook, 1952

?*Quadracythere* sp. 3333

Figs 62B–C, 64

Illustrated material

	length	height
MF-0719, RV, TBD 6835, 100 m	0,90	0,54
MF-0721, RV, TBD 6823, 120 m	0,89	0,53

Material

Twelve valves.



Fig. 64. Muscle scars of ?*Quadracythere* sp. 3333, MF-0721, RV, TBD 6823, 120 m. Scale: 100 μ .

Remarks

This robust, strongly ornamented species has a prominent ventrolateral ridge, and prominent posterodorsal and posteroventral protuberances. Primary muri are delicately ornamented with secondary reticulation. The hinge is typical for the genus *Quadracythere* s.l., with a crenulate ME, and the MS pattern is hemicytherid (MF-0721) (Fig. 64).

On the grounds of external morphology alone, I would place this species in *Hermanites* but its non-trachyleberid MS suggest that it belongs in *Quadracythere*. It is similar to ?*Quadracythere* sp. Uffenorde, 1981 (pl. 7 (figs 19–20)), from the Upper Miocene of north-western Germany.

Distribution

With the possible exception of a modern juvenile at site TBD 5254 (40 m), all specimens of ?*Quadracythere* sp. 3333 were relict. All sites, except TBD 2472 (201 m, Orange–Namaqualand shelf), lie adjacent to the Cape Peninsula, with a depth range of 58–131 m.

Genus *Urocythereis* Ruggieri, 1950

The only published record of this genus in the South Atlantic area, outside southern Africa, is by Dias-Brito *et al.* (1988) from Sepetiba Bay near Rio de Janeiro (*Urocythereis* sp.). Hartmann (1974) did not find it in his studies of coastal Angola.

In southern Africa, *Urocythereis* is moderately diverse but numerically rare: Frewin (1987) illustrated, under two specific names, what is probably a single species from the Eocene of the Agulhas Bank, and eight species are known from the Quaternary of the continental shelf: *U. arcana* sp. nov. (west coast and Agulhas Bank); *Urocythereis* sp. Benson & Maddocks, 1964 (Knysna Lagoon); *Urocythereis* sp. A Keeler, 1981 (Agulhas Bank); four species of uncertain taxonomic status from the west coast and Agulhas Bank (this paper), and a further specimen of uncertain status illustrated by Sylvester-Bradley & Benson (1971, fig. 7) from False Bay.

Urocythereis arcana sp. nov.

Figs 62D–F, 65A–B

Urocythereis sp. B Keeler, 1981: 101–103, pl. 5 (figs 11–13).*Urocythereis* sp. Boomer, 1985: pl. 4 (fig. 56), fig. 7.*Derivation of name*

Arca—Latin, box; reference to box-like shape.

Holotype

	length	height
MF-0656, RV, TBD 6836, 80 m	1,00	0,50

Paratypes

	length	height
MF-0657, LV, TBD 6836, 80 m	0,89	0,42
MF-0658, LV, TBD 2973, 173 m	0,95	0,50
MF-0659, RV, TBD 2973, 173 m	0,80	0,40

Material

169 valves.

Diagnosis

Species of *Urocythereis* with SCT, and a square posterior aspect that imparts a box-like shape to the valves in lateral view.

Description

External features. Quadrate lateral outline with broadly rounded AM, straight sub-parallel DM and VM, and truncated PM outline with prominent posteroventral and dorsal angles. Overall, the posterior outline has a squared aspect, with elevated ventral regions. In RV, the dorsal side of the PM is somewhat concave, whereas in the LV the PM outline is more pointed. The valve surface adjacent to the VM is elevated, with an angular carina and, overall, the general valve outline is box-like. The SCT is low, but prominent, and the eye spot is subdued and set away from the valve margin. Ornamentation is coarsely reticulate, with more-elongate fossae near the valve margins.

Internal features. Typical for the genus. MS pattern consists of six adductor scars and three anterior scars. The marginal areas are avestibulate, with numerous fine straight anterior MPC.

Remarks

Although its ornamentation and overall shape are typical for the genus, the box-like valve shape serves to distinguish *U. arcana* sp. nov. from the type species (*U. favosa* (Roemer)), and other European species (see Athersuch 1977). The species recorded by Dias-Brito *et al.* (1988) from Brazil has distinctive, elongate fossae and a posteriorly sloping DM.

In southern Africa, the closest species is that illustrated as two separate species by Frewin (1987) — *Urocythereis* sp. A1460 and *Urocythereis* sp. 272—but which are probably LV and RV of the same taxon. These appear to have a more rounded posterior outline and less elongate fossae than generally observed in *U. arcana*.

In comparison to my new species, *Urocythereis* sp. Benson & Maddocks, 1964, from Knysna Lagoon is smaller, has a more bulbous AM outline, rounded posterior regions, a distinctly radiating reticulation based on the SCT, and an eye spot that lies close to the valve margin. This is probably an estuarine taxon, because Keeler (1981) did not record it on the continental shelf adjacent to Knysna.

The species recorded by Keeler (1981) as *Urocythereis* sp. A has a rounded posterior outline, and does not penetrate farther west than the Agulhas Bank.

Distribution

Urocythereis arcana occurs on the continental shelf around southern Africa from approximately 20°S on the west coast to 23°E on the eastern Agulhas Bank (Fig. 66A).

Modern valves have been recovered from two inshore sites, both in the south-western Cape (TBD 5254: 40 m, False Bay; and TBD 6821: 15 m, Hout Bay).

Relict populations occur in two areas, where they have similar LDL, but different UDL (Fig. 66B). Between 20° and 28°S, *U. arcana* occupies a relatively narrow depth range (154–223 m) on the middle continental shelf, whereas off the south-western Cape,

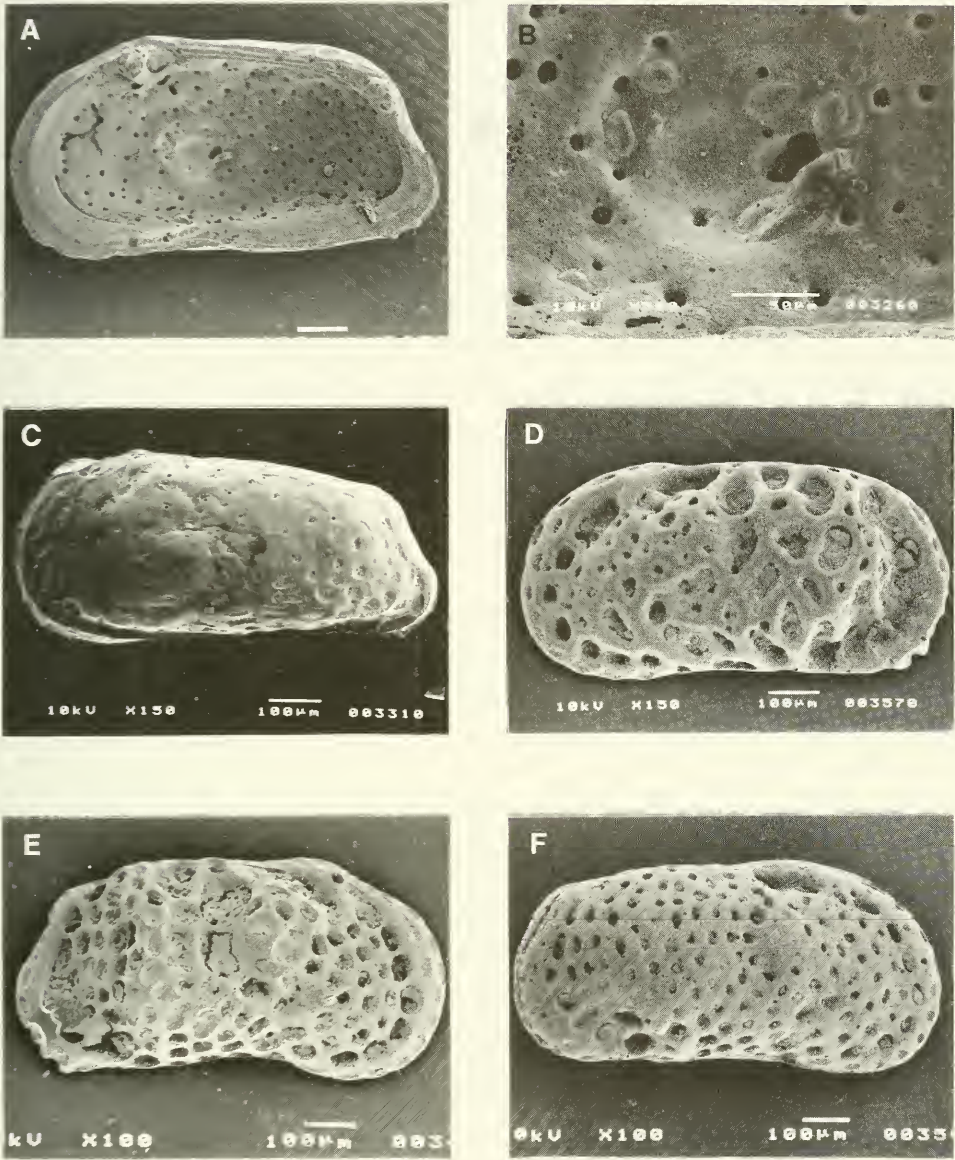


Fig. 65. A–B. *Urocythereis arcana* sp. nov., MF-0659, paratype, RV, TBD 2973, 173 m. A. SEM 3257. B. MS, SEM 3260. C. ?*Urocythereis* sp. 3310, MF-0710, LV, TBD 6821, 15 m, SEM 3310. D. ?*Urocythereis* sp. 3570, MF-0785, LV, TBD 3769, 223 m, SEM 3570. E. ?*Urocythereis* sp. 3472, MF-0767, RV, TBD 1690, 172 m, SEM 3472. F. ?*Urocythereis* sp. 3567, MF-0784, C, TBD 3769, 223 m, SEM 3567. Scales: A, C–F = 100 μ , B = 50 μ .

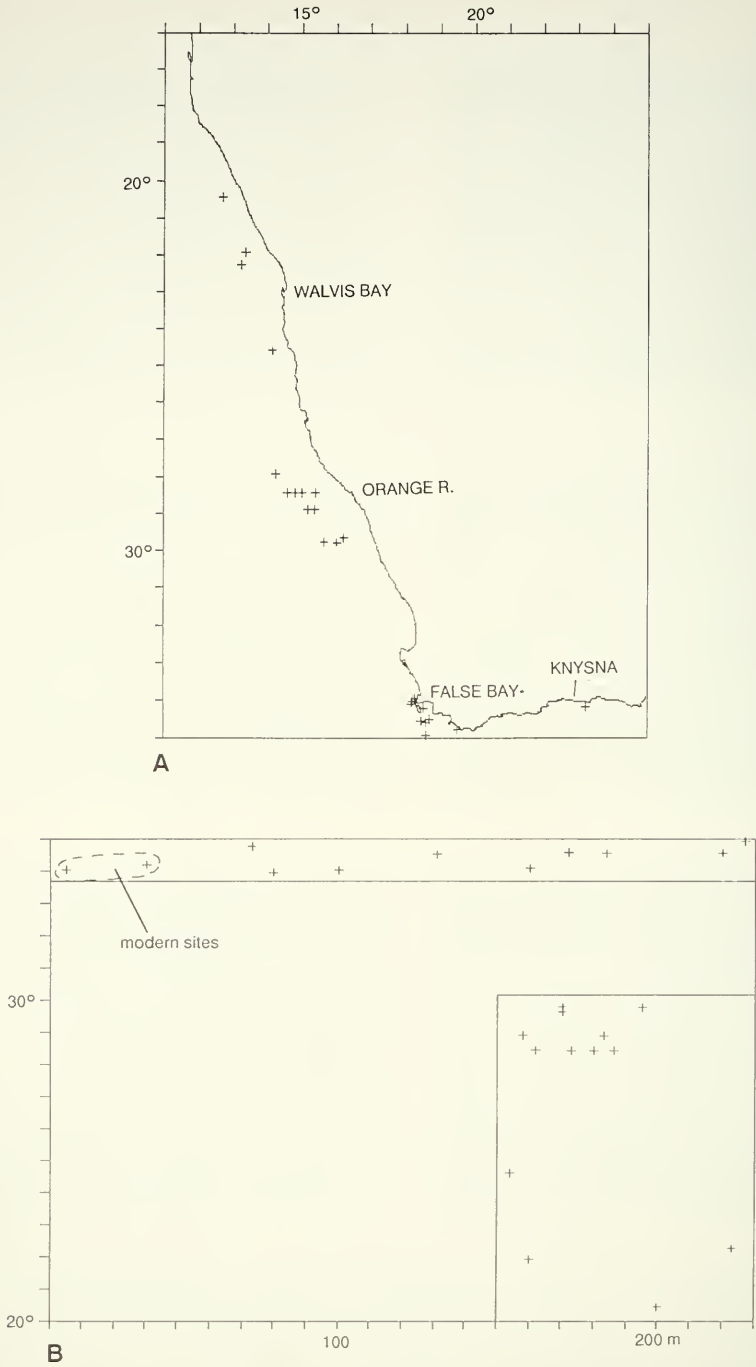


Fig. 66. Distribution of *Urocythereis arcana* sp. nov. A. On the continental margin off south-western Africa. B. Latitude versus water depth. Modern sites (off south-western Cape) lie within dashed line.

the UDL occurs at 15 m (Hout Bay) and the LDL is 227 m. A further site occurs on the eastern Agulhas Bank, and a single valve at site TBD 3002 (1 180 m), north-west of the Orange River, is considered allochthonous.

Species of uncertain taxonomic status, provisionally placed in ?Urocythereis

Four species have been recorded during the present study from south and south-western Africa that have various attributes of the genus *Urocythereis*, but some of these probably belong to new genera. These include the species cf. *Urocythereis* illustrated by Sylvester-Bradley & Benson (1971), from False Bay, which was referred to by Athersuch (1977: 247).

?Urocythereis sp. 3310

Fig. 65C

Illustrated material

	length	height
MF-0710, LV, TBD 6821, 15 m	0,76	0,35

Material

Two valves.

Remarks

The specimens are possibly juveniles of a large species similar to *Urocythereis arcana* sp. nov., but have different ornamentation adjacent to the AM and possess a PM rim.

Distribution

This species was recovered modern only at site TBD 6821 (15 m) in Hout Bay.

?Urocythereis sp. 3570

Fig. 65D

Coquimba sp. A Keeler, 1981: 110-112, pl. 6 (fig. 5).

Illustrated material

	length	height
MF-0785, LV, TBD 3769, 223 m	0,80	0,40

Material

One valve

Remarks

A species characterized by large deep fossae and a strongly compressed PM area.

Distribution

This species was recovered relict only from site TBD 3769 (223 m) on the outer shelf off Walvis Bay. Keeler (1981) also found it on the eastern Agulhas Bank (TBD 1259: 91 m).

?Urocythereis sp. 3472

Fig. 65E

Coquimba rugosa Keeler, 1981: 106–108, pl. 5 (figs 18–20) (invalid name—unpublished MS).*Illustrated material*

	length	height
MF-0767, RV, TBD 1690, 172 m	0,80	0,40

Material

One valve.

Remarks

A distinctive strongly reticulate species, with a large, circular, turret-like SCT, a concave VM, and a prominent vertical ridge that divides the posterior and median areas of the valve surface.

Distribution

This species was recovered relict from site TBD 1690 (172 m) south of False Bay. Keeler (1981) found it on the eastern Agulhas Bank, where it has UDL and LDL of 91 m and 127 m, respectively.

?Urocythereis sp. 3567

Fig. 65F

Urocythereis sp. A Keeler, 1981: 100–101, pl. 5 (figs 8–10).*Illustrated material*

	length	height
MF-0784, C, TBD 3769, 223 m	0,84	0,42

Material

Two valves.

Remarks

A reticulate species, similar to, but not conspecific with, that illustrated by Sylvester-Bradley & Benson (1971).

Distribution

This species was recovered relict from site TBD 3769 (223 m) off Walvis Bay. Keeler (1981) also found it on the eastern Agulhas Bank.

Genus *Coquimba* Ohmert, 1968

This genus was first reported from the Pliocene of Chile (Ohmert 1968), and has since been recorded from the Caribbean (Van den Bold 1971), Far East (Whatley & Watson 1988), and the South Atlantic (Brazil—Dias-Brito *et al.* 1988). No species of *Coquimba* have previously been noted from southern Africa.

Coquimba birchi sp. nov.

Fig. 67A–E

Derivation of name

This species is named for Dr G. F. Birch (University of Sydney), a colleague on many geological cruises off southern Africa, and for his contribution to knowledge of sediments of the west-coast continental shelf.

Holotype

	length	height
MF-0660, LV, TBD 270, 131 m	0,55	0,34

Paratypes

	length	height
MF-0661, RV, TBD 270, 131 m	0,56	0,31
MF-0662, RV, TBD 270, 131 m	0,61	0,32
MF-0663, LV, TBD 270, 131 m	0,60	0,32

Material

86 valves.

Diagnosis

A heavily calcified species of *Coquimba* with a deeply etched ornamentation of short irregular riblets and nodes, which form a semi-circular pattern posterior to the SCT. A thick ventrolateral rib runs from just below mid-height at three-quarters valve length to the anteroventral corner.

Description

External features. Robust, heavily calcified valves. Quadrate in outline with broadly rounded AM and PM. Posterior half of valve is somewhat inflated. VM is almost straight, with a slight concavity at one-third length. DM straight but hidden behind DM rib. Ornamentation consists of short, irregular ribs and nodes with a flat outer surface, the overall appearance being of deeply etched features. Posterior to a low sub-central feature, the ribs form a coarse, semi-circular reticulation. Prominent linear features are: a thick rim parallel to and set back slightly from the AM that commences at a prominent, low eye spot; an anteroventrally inclined longitudinal rib that runs in the ventrolateral region from about three-quarters valve length to just behind the AM rim; and an irregular, varicose DM rib that is deflected ventrally at the PCA. Valve surface immediately posterior to AM rim is strongly depressed.

Internal features. MA relatively narrow. There is a prominent flange groove around the RV. Hinge is amphidont. No unequivocal view of the MS was obtained, but they appear to consist of a large V-shaped anterior scar, four adductors—the second being elongate, and with two further scars lying dorsal to the main group.

Remarks

Coquimba birchi sp. nov. bears a strong resemblance to *C. labyrinthica* Ohmert, 1968, from the Upper Pliocene of Chile, particularly in their similarly curious, irregular

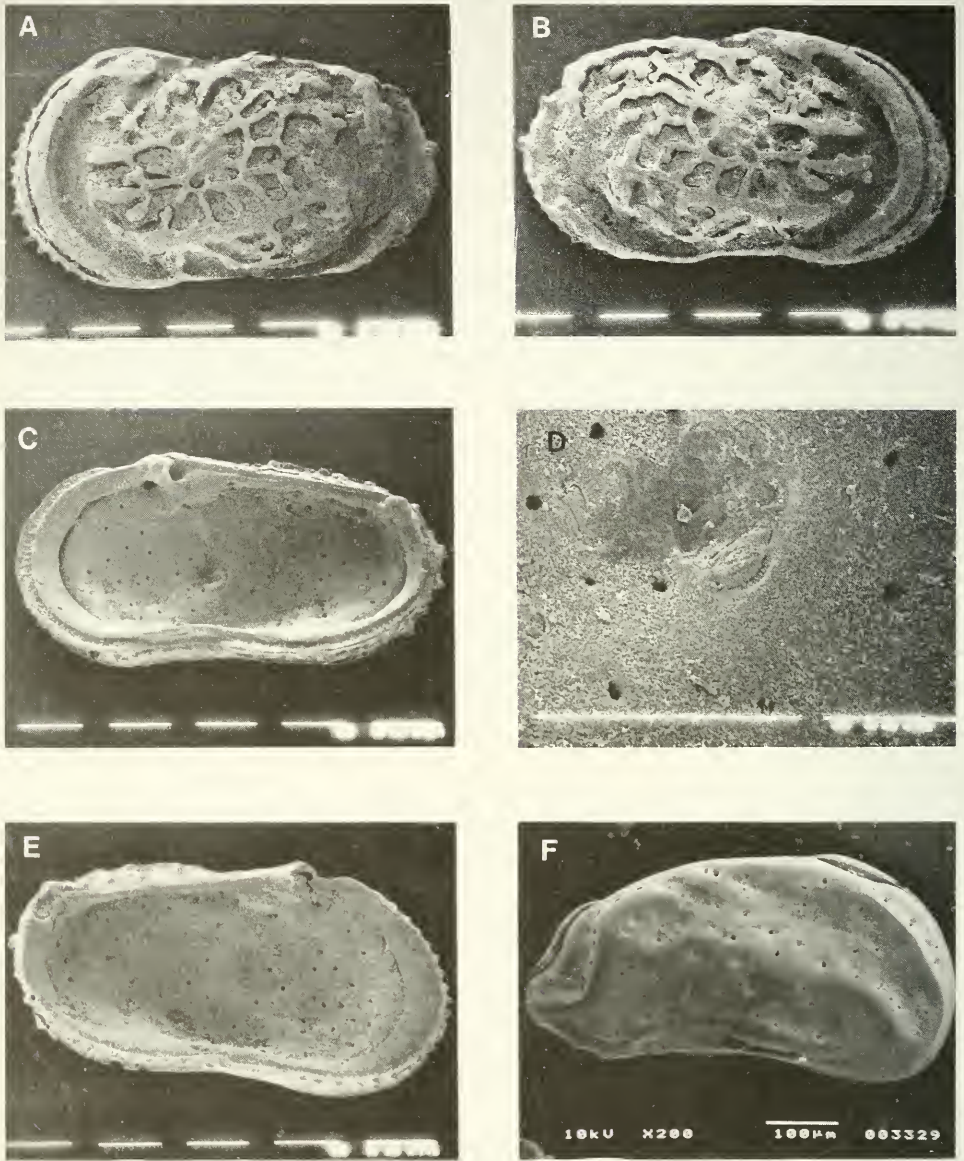


Fig. 67. A-E. *Coquimba birchi* sp. nov., TBD 270, 131 m. A. MF-0660, holotype, L.V., SEM 2978. B. MF-0661, R.V., SEM 2980. C-D. MF-0662, paratype, R.V. C. Internal view, SEM 2981. D. MS, SEM 2983. E. MF-0663, paratype, L.V., internal view, SEM 2975. F. *Caudites* sp. 3329, MF-0717. C. TBD 2224, 58 m, right view, SEM 3329. Scales: all 100 μ .

ornamentation. They differ principally in PM outline (*C. birchi* is rounder), the lack of an inclined ventrolateral rib in *C. labyrinthica*, and in the MS pattern, which, in the Chilean species, lacks the well-developed V-shape anterior scar of *C. birchi*. Dias-Brito *et al.* (1988, pl. 2 (fig. 23)) recorded a Recent species as *Coquimba* cf. *C. labyrinthica* from a bay near Rio de Janeiro; their illustration depicts a specimen somewhat more elongate and with a less tortuous rib pattern than Ohmert's types, although the PM outline is more like the Chilean species than my material.

Distribution

Coquimba birchi was encountered only off the south-western Cape (Fig. 68), where it is relatively abundant (2,2% of the fauna in the samples in which it occurs).

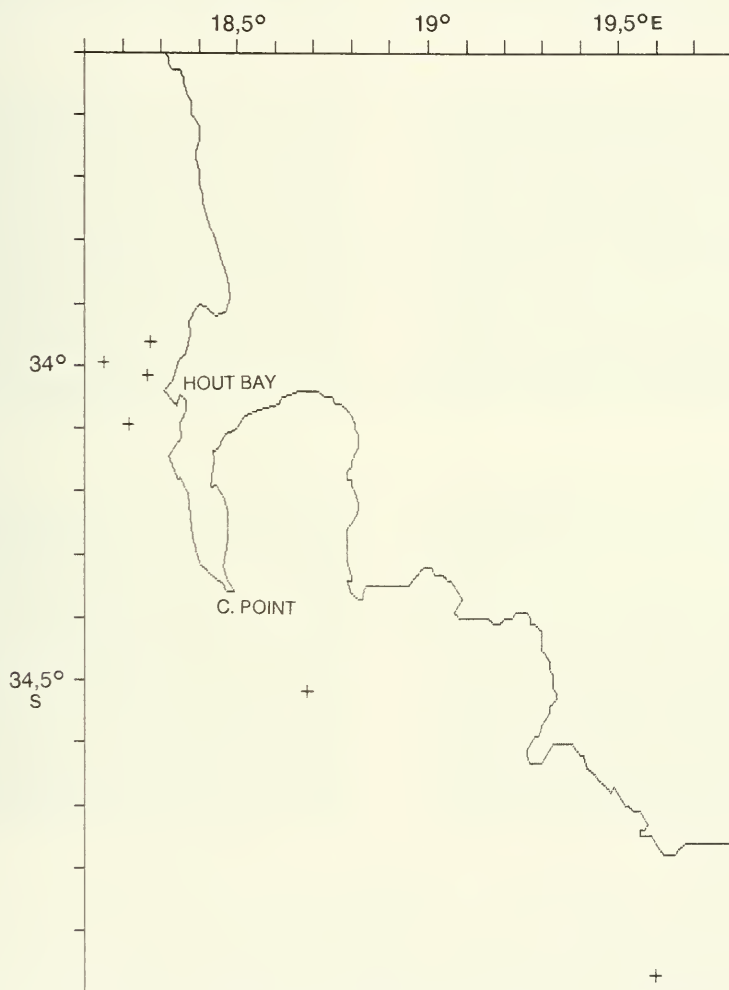


Fig. 68. Distribution of *Coquimba birchi* sp. nov. on the continental shelf off south-western Africa.

Modern valves were recovered only from site TBD 346 (133 m) south-west of Cape Agulhas.

Relict specimens all lie farther west and the UDL and LDL are 80 m and 140 m, respectively.

Genus *Caudites* Coryell & Fields, 1937

Caudites sp. 3329

Fig. 67F

Illustrated material

	length	height
MF-0717, C, TBD 2224, 58 m	0,59	0,29

Material

Two valves.

Remarks

Caudites sp. 3329 is very similar externally to *C. africana* Omatsola, 1972, from the nearshore shelf (20 m) off Lagos Lagoon. The main difference between the two species is the presence, in *Caudites* sp. 3329, of a fine rib parallel to the AM.

Distribution

This species was recovered only at site TBD 2224 (58 m) off Saldanha Bay.

Genus *Basslerites* Howe, 1937 (in Coryell & Fields, 1937)

Subgenus *Loculiconcha* Omatsola, 1970

?*Basslerites* (*Loculiconcha*) sp. 3444

Fig. 69A

Illustrated material

	length	height
MF-0756, C, TBD 6846. 95 m	0,47	0,24

Material

Two valves.

Remarks

This species is tentatively placed in *B. (Loculiconcha)* on overall shape, smooth ornamentation, and the distinctly punctate/loculate posterior area. It is similar to *B. (L.) punctatus* Omatsola, 1972, from the western Niger Delta (depth range 20–30 m). ?*Basslerites* (*L.*) sp. 3444 is the only record of the genus from southern Africa.

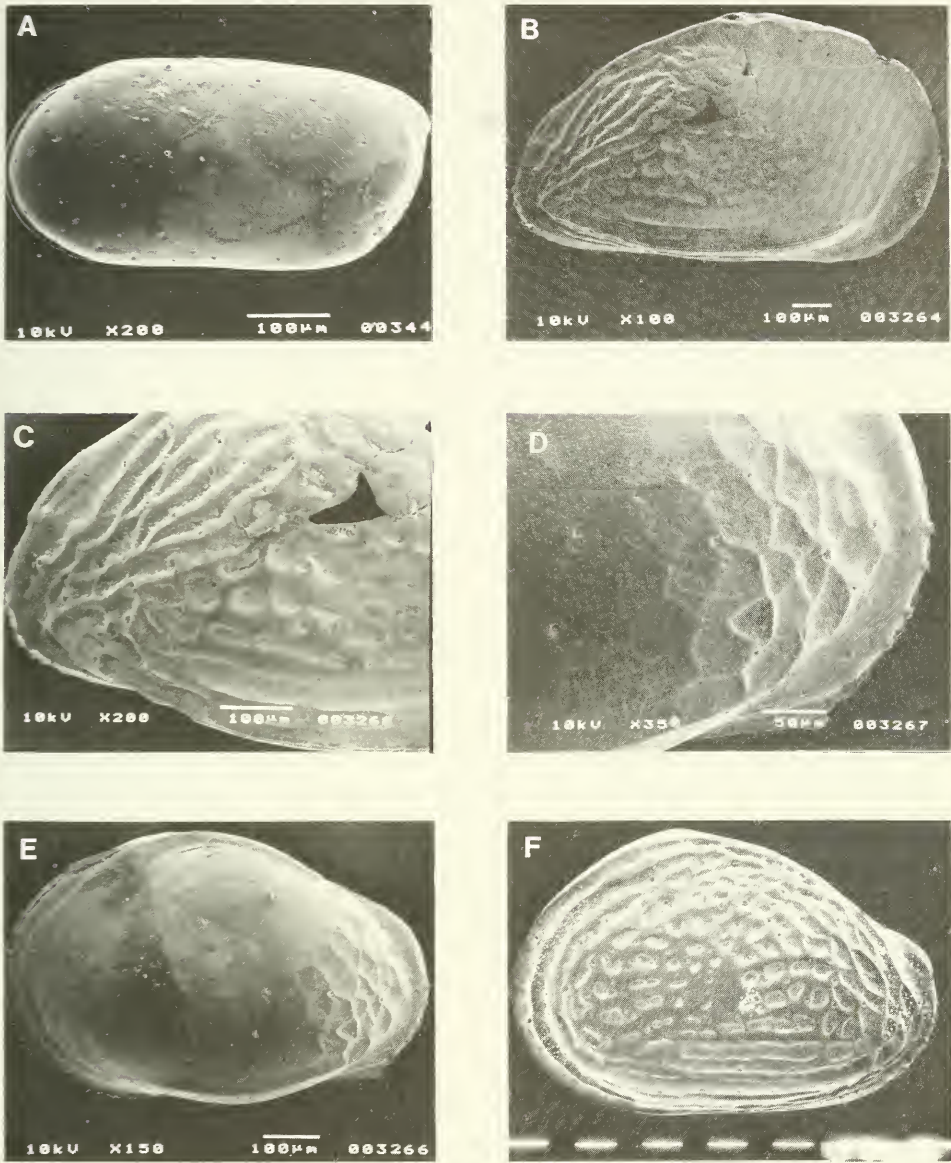


Fig. 69. A. ?*Basslerites* (*Loculiconcha*) sp. 3444, MF-0756, C, TBD 6846, 95 m, left view, SEM 3444. B-E. *Buntonia rosenfeldi* Dingle, Lord & Boomer, 1990. B-C. MF-0664, RV, TBD 3109, 900 m. B. SEM 3264. C. Detail of posterior area, SEM 3268. D-E. MF-0665, LV, TBD 3462, 430 m, juvenile. D. Detail of posterior area, SEM 3267. E. SEM 3266. F. *Buntonia namaquaensis* sp. nov., MF0666, holotype, LV, TBD 2446, 310 m, SEM 2843. Scales: A-C, E-F = 100 μ , D = 50 μ .

Distribution

This species was recovered only from site TBD 6846 (95 m) off the western Cape Peninsula.

Family **Buntoniidae** Apostolescu, 1961Genus *Buntonia* Howe, 1935 (in Howe & Chambers, 1935)

Buntonia s.l. is a diverse genus in the Tertiary of West Africa, where Reyment (1960, 1963) and Apostolescu (1961) recorded twelve species in Eocene–Palaeocene strata, and Van den Bold (1966) described three species from Mio–Pliocene strata of Gabon. Rosenfeld & Bein (1978) did not note the genus on the continental shelf off north-western Africa, but recorded two species in deeper water: *B. pyriformis* (Brady, 1880: 400–830 m), and *B. rosenfeldi* Dingle, Lord & Boomer, 1989 (as *B. sulcifera?* (Brady): 2 093–2 859 m).

There is no analogous temporal distribution in southern Africa, with a poor fossil record contrasting with a relatively diverse and moderately abundant Quaternary presence. The total record for pre-Neogene time currently amounts to one carapace (*Buntonia?* sp.) from Upper Cretaceous strata of south-east Africa (Dingle 1981), and one broken carapace from the Upper Eocene of offshore Natal (Dingle 1976). Mio–Pliocene faunas are undescribed.

Seven species of *Buntonia* occur in Quaternary sediments on the continental margin off south-western Africa. The northward extent of these modern populations is unknown because, although neither Hartmann (1974) nor Babinot & Kouyoumontzakis (1986) recorded the genus from Angola and the Congo estuary, respectively, it is possible that their surveys were too shallow to have encountered the taxa. Peypouquet & Benson (1980) found the genus in deep water off Angola but again did not sample the continental shelf. *Buntonia* does not, apparently, extend far eastward on to the Agulhas Bank, because Keeler (1981) did not record it along a traverse at 23°E.

Although all six of the extant species of *Buntonia* occur on the inner shelf off south-western Africa, only two extend beyond the shelf break on to the continental slope, and the sole representative in deep water is *B. rosenfeldi*, which is the species that occurs in similar depths off north-western Africa. No modern specimens of *B. deweti* were recovered.

Buntonia rosenfeldi Dingle, Lord & Boomer, 1990

Fig. 69B–E

Buntonia sulcifera? (Brady, 1887) Rosenfeld & Bein, 1978: 18, pl. 1 (fig. 21).

Buntonia sp. 1 Boomer, 1985: 34–35, pl. 2 (figs 27–28).

Buntonia sp. 2 Boomer, 1985: 35–36, pl. 2 (figs 33–34).

Buntonia rosenfeldi Dingle, Lord & Boomer, 1990: 289–293, figs 23E–F, 27A–D.

Illustrated material

	length	height
MF-0664, RV, TBD 3109, 900 m	0,99	0,58
MF-0665, LV, TBD 3462, 430 m	0,73	0,47



Fig. 70. Distribution of *Buntonia rosenfeldi* Dingle, Lord & Boomer, 1990. A. On the continental shelf off south-western Africa. Modern sites shown as black squares. B. Abundance as percentage of ostracod fauna plotted against water depth (five-point running mean). Maximum values lie c. 1 500 m in the vicinity of the Antarctic Intermediate Water–North Atlantic Deep Water boundary (see Dingle *et al.* 1990).

Material

47 valves (<950 m).

Distribution

Buntonia rosenfeldi occurs on the continental shelf between 21° and 36°S, in two areas separated by a barren zone north-west of Lüderitz (Fig. 70A), and has an UDL of 186 m and a LDL of 2 619 m (the latter is from an unpublished site not included in the present survey: TBD 7180). It is the only species of the genus that has a deep-water presence.

Modern populations have a relatively wide distribution between Lüderitz and the Cape Peninsula, in water depths that range from outermost shelf to upper slope (430–1 610 m). A further site lies north of 27°S.

Relict populations occur from the middle shelf to the middle continental slope in a depth range 186 m to 2 619 m. The cross-margin abundance of *B. rosenfeldi* rises steadily to the vicinity of 900 m, below which it fluctuates, before becoming a major component of the fauna at about 1 500 m. Below this depth it rapidly becomes less abundant, with my deepest record at 2 619 m.

Buntonia namaquaensis sp. nov.

Figs 69F, 71A–D

Derivation of name

The main population centre lies off the Namaqualand coast.

Holotype

	length	height
MF-0666, LV, TBD 2446, 310 m	0.94	0,64

Paratypes

	length	height
MF-0667, RV, TBD 2446, 310 m	1,00	0,60
MF-0668, LV, TBD 2879, 530 m	1.00	0,68

Material

37 valves.

Diagnosis

Reticulate species of *Buntonia* with strong ribbing sub-parallel to the AM and VM, and a small, flat, ovate sub-central feature.

Description

External features. Typical buntonid outline, with strongly inflated AM and upturned PM outlines in LV, and a quasi-triangular shaped RV. In both valves, the highest point lies just anterior of the sub-central feature. Surface ornamentation consists of two strong ribs sub-parallel to the AM and four short, straight ribs parallel to the VM; the ventral-most two are continuous with the anterior ribs. Overall, the lateral surface is coarsely

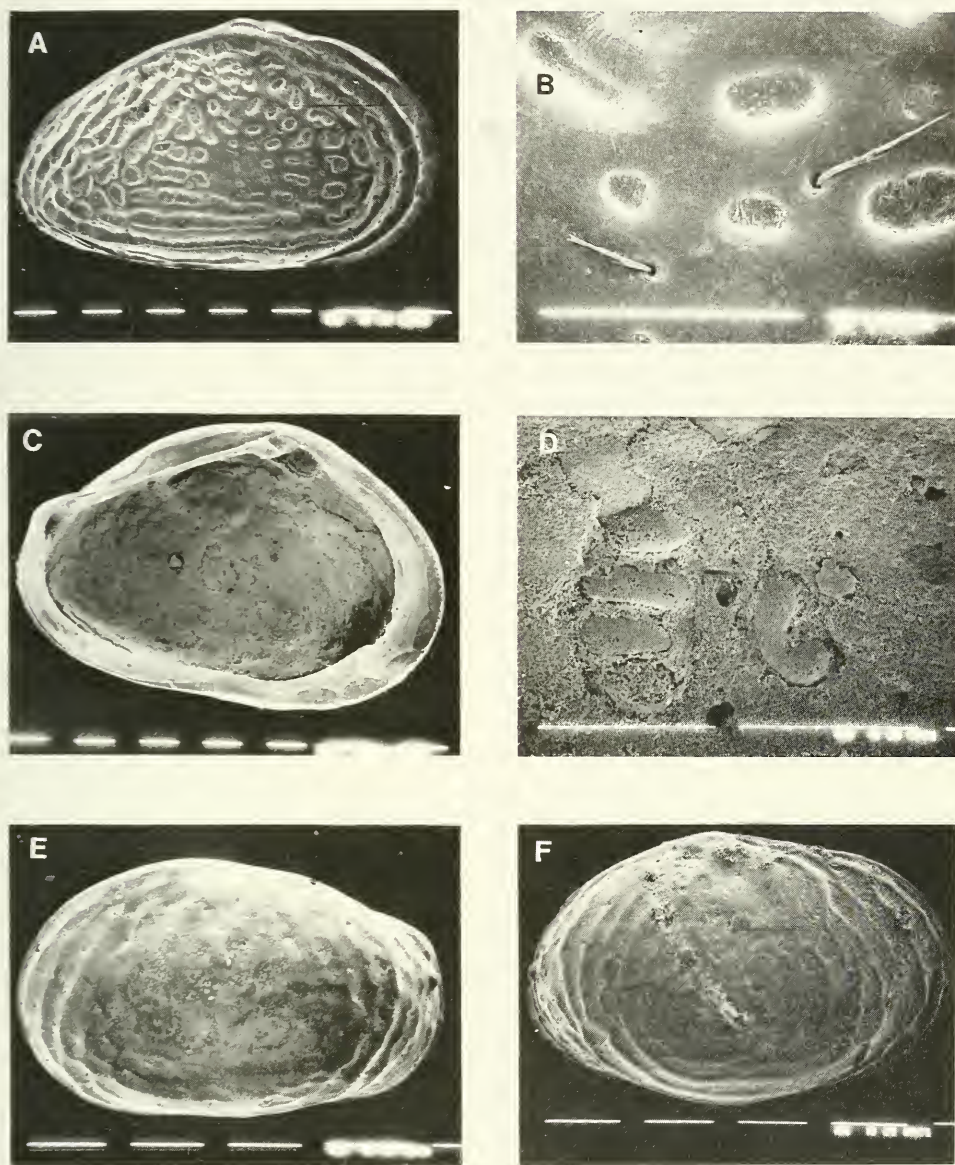


Fig. 71. A–D. *Buntonia namaquaensis* sp. nov., paratypes. A–B. MF-0667, RV, TBD 2446, 310 m. A. SEM 2846. B. Detail of ornamentation in central area, SEM 2847. C–D. MF-0668, LV, TBD 2879, 530 m. C. Internal view, SEM 2848. D. MS, SEM 2850. E–F. *Buntonia rogersi* sp. nov. E. MF-0669, holotype, LV, TBD 270, 131 m, SEM 2816. F. MF-0670, paratype, RV, TBD 3523, 295 m, SEM 2825. Scale: all 100 μ .

reticulate, with rather elongated fossae. Sub-centrally there is a small, ovate flat area over the MS from which short ribs radiate in the central valve area.

Internal features. The hinge is characterized by a particularly straight, narrow, smooth ME bar in LV. MS consist of an elliptical cluster of four adductors and a 'fish hook'-shaped anterior scar.

Remarks

The closest relative to *B. namaquaensis* sp. nov. is the Miocene species *B. radiatopora* (Seguenza, 1880), which has been recorded from the Mediterranean (e.g. Colalongo 1966), and Gabon (Van den Bold 1966, pl. 1 (fig. 3)). The two species can be distinguished by the ornamentation in the posterior half: in *B. radiatopora* ribs parallel to the VM and DM converge posteriorly, whereas in *B. namaquaensis* the median and posterodorsal part of the valve is reticulate. In this respect, *B. radiatopora* is very similar to *B. sulcifera* (Brady), but both *B. radiatopora* and *B. sulcifera* lack the flat, ovate sub-central feature on the exterior surface of *B. namaquaensis*.

Distribution

Buntonia namaquaensis sp. nov. occurs in a relatively narrow zone along the mid- to outer shelf between 20°S and 35°S (Fig. 72A).

Modern specimens were collected only at site TBD 2446 (310 m) on the Namaqualand shelf.

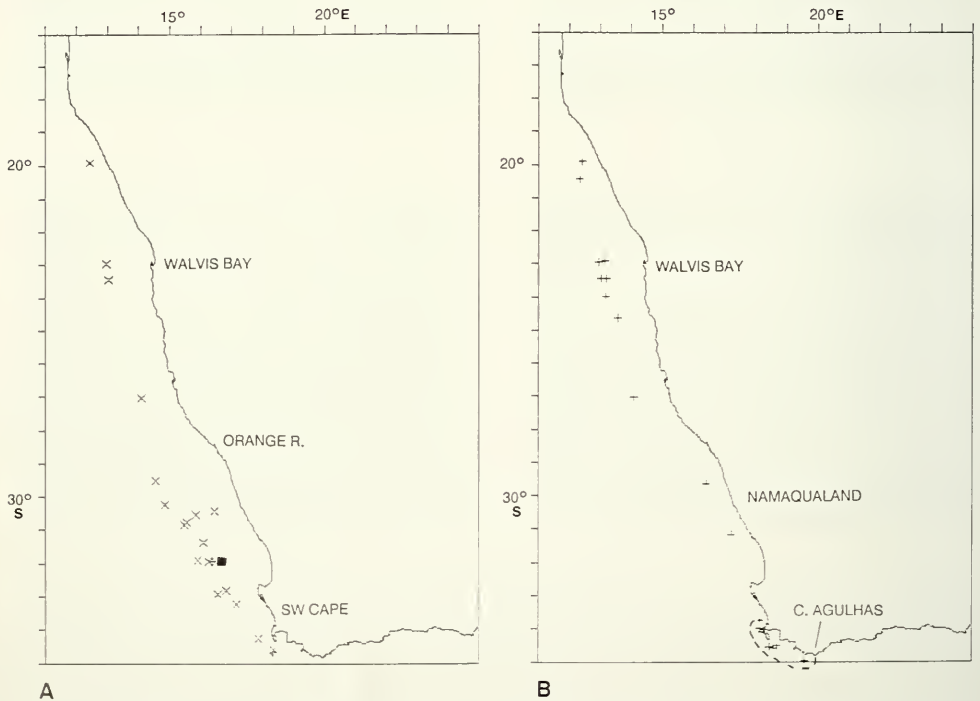


Fig. 72. Distribution of *Buntonia* on the continental margin off south-western Africa. A. *B. namaquaensis* sp. nov. (modern site = black square). B. *B. rogersi* sp. nov. (modern sites enclosed by dashed line).

Relict populations in the south have UDL and LDL of 218 m and 530 m, respectively, whereas north of 28°S, with the exception of the northernmost site (150 m), the UDL is >400 m, and the LDL is 590 m.

Buntonia rogersi sp. nov.

Figs 71E–F, 73A–F, 74A

Derivation of name

This species is named for Dr J. Rogers (University of Cape Town), a colleague on many marine geological cruises off southern Africa, and for his contribution to knowledge of sediments on the Orange Shelf.

Holotype

	length	height
MF-0669, LV, TBD 270, 131 m	0,54	0,35

Paratypes

	length	height
MF-0670, RV, TBD 3523, 295 m	0,57	0,38
MF-0671, LV, TBD 3523, 295 m	0,52	0,36
MF-0672, RV, TBD 3587, 140 m	0,51	0,32

Material

47 valves.

Diagnosis

Inflated ovate species of *Buntonia* with a small, prominent, blunt spine on the exterior surface near the central PM. There is an elongate extension of the DM surface over the PTE in the RV.

Description

External features. Inflated, elliptical valve outline, with a more quadrate aspect in the LV. AM broadly rounded, PM somewhat truncated in LV, narrowly rounded in RV. VM straight in LV, slightly convex in RV. The DM varies considerably: in LV it is fairly straight, with a slight, typically buntonid inflexion posterodorsally; in RV the DM is convex, with a slight concavity anterodorsally that results from a cutaway of the DM above the ATE of the hinge. Lateral surface ornamentation consists of weak ribbing sub-parallel to the AM and PM, with areas of weak, small-scale reticulation over the valve surface. There is a small, blunt spine near the PM just above the line of greatest length.

Internal features. AM area moderately wide. Hinge is modified merodont. In LV the PTE consists of a large, elongate smooth socket, the ME is a crenulate bar, and the ATE is an elongate socket that has small denticles on its posterior portion and terminates anteriorly in a smooth conical depression. The ATE lies beneath a hood-like extension of the DM. This complex ATE structure produces a convex feature in the LV seen in internal lateral view, but in RV it results in a cut-away outline that isolates the conical

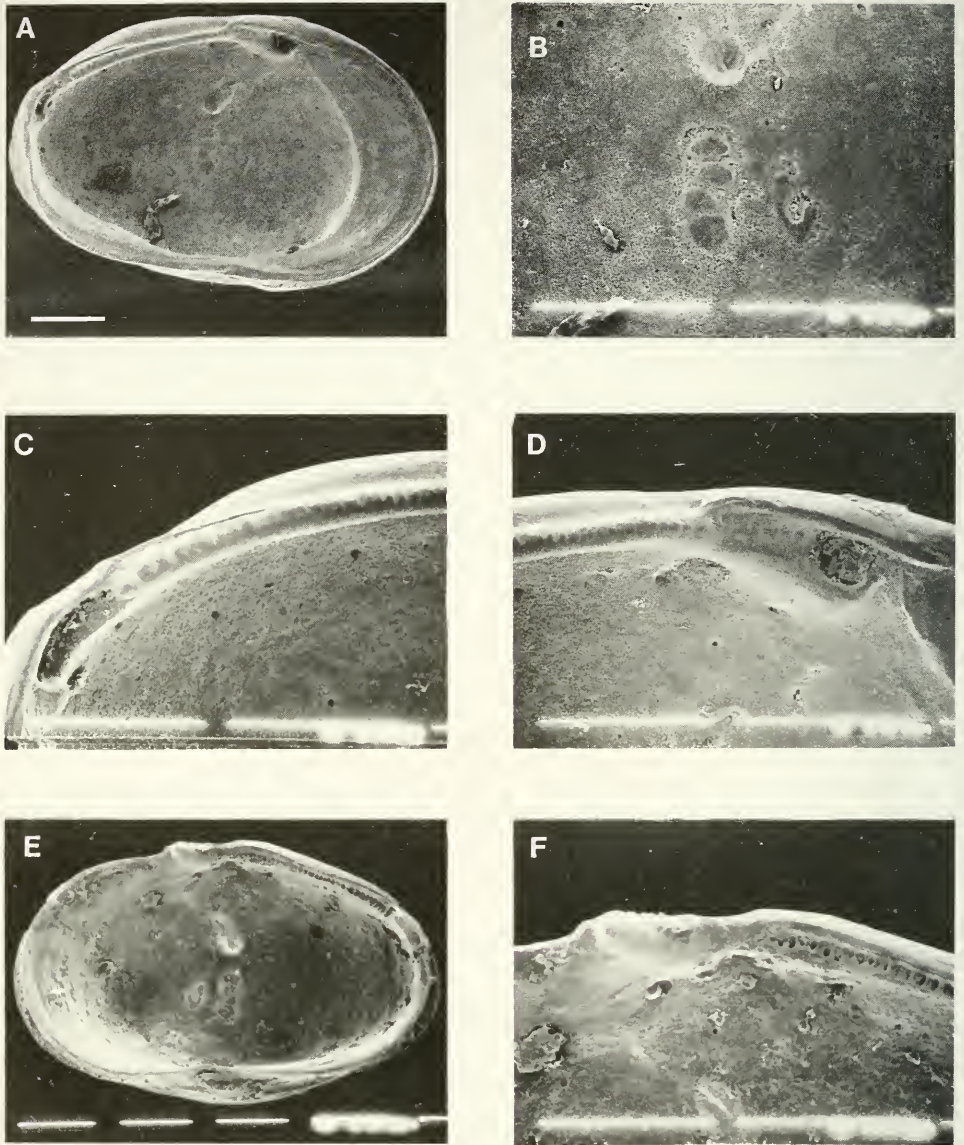


Fig. 73. A-F. *Buntonia rogersi* sp. nov., paratypes. A-D. MF-0671, LV, TBD 3523, 295 m. A. Internal view, SEM 2827. B. MS, SEM 2829. C. PTE, SEM 2830. D. ATE, SEM 2831. E-F. MF-0672, RV, TBD 3587, 140 m. E. Internal view, SEM 2821. F. ATE, SEM 2823. Scales: all 100 μ .

ATE tooth above the DM. The MS consist of four rounded adductors and a V- or 'fish hook'-shaped anterior scar. There is prominent fulchral point dorsal to the adductors.

Remarks

Buntonia rogersi sp. nov. is similar in outline and ornamentation to *B. subulata subulata* Ruggieri, 1954, from the Miocene of Italy. The two species have a similar ATE hinge structure, but can be distinguished by the more elongate valve outline and less convex VM of *B. s. subulata*. In addition, apart from the single stubby PM spine, *B. rogersi* has no spinose ornamentation in the posterior part of its valves, whereas Ruggieri (1954) illustrates numerous small spines on the types *B. s. subulata*.

Distribution

Buntonia rogersi occurs at isolated sites along margin between 20°S and 35°S (Fig. 72B).

Modern specimens were recovered between the Cape Peninsula and Cape Agulhas, where the UDL and LDL are 95 m and 140 m, respectively.

Relict populations extend from south of False Bay to Walvis Bay, and have UDL and LDL of 150 m and 590 m, respectively.

Within the overall ostracod population, *B. rogersi* is most abundant in the depth range 300–400 m (outer shelf).

Buntonia bremneri sp. nov.

Fig. 74B–F

Derivation of name

This species is named for Dr J. M. Bremner (Geological Survey of South Africa), for his contributions to our understanding of the relationships between oceanic upwelling and sedimentation on the south-west African margin.

Holotype

	length	height
MF-0673, RV, TBD 6825, 160 m	0,52	0,36

Paratypes

	length	height
MF-0674, LV, TBD 1690, 172 m	0,50	0,38
MF-0675, LV, TBD 6823, 120 m	0,50	0,38
MF-0676, RV, TBD 1690, 172 m	0,50	0,32

Material

79 valves (<950 m).

Diagnosis

A species of *Buntonia* with a prominent ocular sinus and delicate reticulation in the anterior and posterior areas.

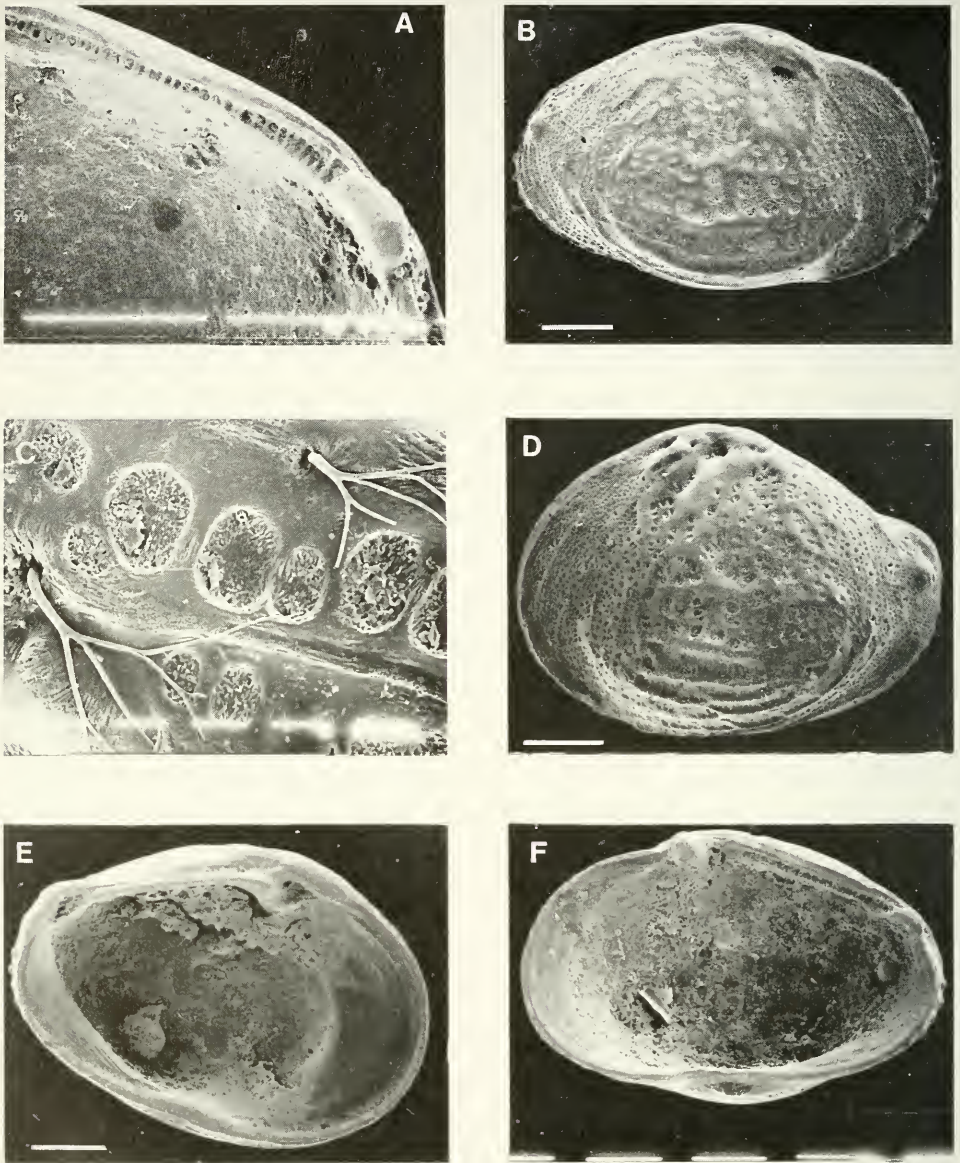


Fig. 74. A. *Buntonia rogersi* sp. nov., MF-0672, paratype, RV, TBD 3587, 140 m, SEM 2824. B-F. *Buntonia bremneri* sp. nov. B-C. MF-0673, holotype, RV, TBD 6825, 160 m. B. SEM 2803. C. Detail of ornamentation in central area, SEM 2805. D. MF-0674, paratype, LV, TBD 1690, 172 m, SEM 2806. E. MF-0675, paratype, LV, TBD 6823, 120 m, internal view, SEM 2812. F. MF-0676, paratype, RV, TBD 1690, 172 m, internal view, SEM 2809. Scales: A-B, D-F = 100 μ , C = 10 μ .

Description

External features. Ovate, inflated valves with broadly rounded AM and narrow PM. In the RV, the PM is rounded but in LV it is quadrate and dorsally upturned. Both valves have a convex DM in the vicinity of a prominent ocular sinus. The central valve area is ornamented with three subdued and irregular, short, longitudinal ribs with poorly defined intercostal reticulation. The broad, depressed anterior and the narrow posterior areas have fine, delicate reticulation.

Internal features. Typical for the genus: wide AM areas and a short holamphidont hinge with denticulate ME.

Remarks

The closest relative of *Buntonia bremneri* is *B. sublattissima dertonensis* Ruggieri, 1954, from the Miocene of Italy, and subsequently recorded from the Lower Miocene of Gabon (Van den Bold 1966). *Buntonia bremneri* differs in possessing a prominent ocular sinus, in having more prominent longitudinal ribs and intercostal reticulation, and a more convex DM.

The new species is similar to *Buntonia* sp. Dingle, 1976, from the Eocene of the Jc-1 borehole, offshore Natal, but the latter has a more drawn out posterior outline and is less inflated in the central part of the valve.

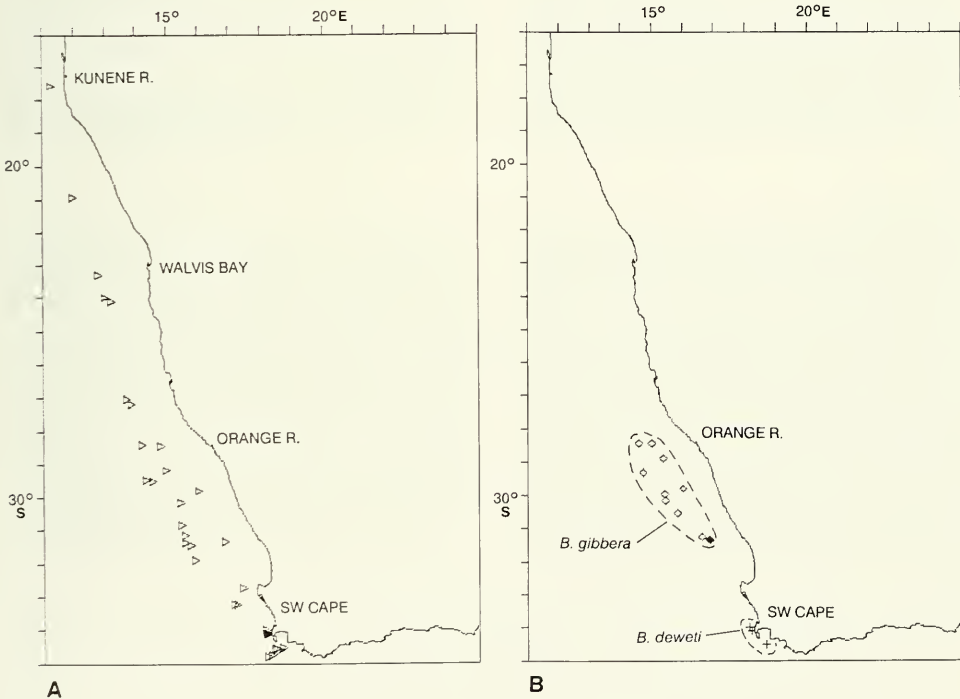


Fig. 75. Distribution of *Buntonia* on the continental margin off south-western Africa. A. *B. bremneri* sp. nov. (modern site shown by black triangle). B. *B. gibbera* (diamonds, modern site in black), and *B. deweti* (crosses).

Distribution

This is the most northerly occurring of the six *Buntonia* species off the west coast (17,5°S to 34,8°S) (Fig. 75A) and, with the exception of *B. rosenfeldi*, has the greatest depth range (120–1 050 m).

Only one modern valve was recovered during the survey from TBD 6825 (160 m) off the Cape Peninsula.

Relict populations occur in two areas. Between the Kunene River and south of Walvis Bay they have UDL and LDL of 725 m and 1 003 m, respectively, whereas between Lüderitz and south of False Bay UDL and LDL are 120 m and LDL 1 050 m, respectively.

Buntonia gibbera sp. nov.

Fig. 76A–E

Derivation of name

Gibbus—Latin, hunched; reference to its hunched shape.

Holotype

	length	height
MF-0677, LV, TBD 2361, 241 m	0,55	0,38

Paratypes

	length	height
MF-0678, RV, TBD 2361, 241 m	0,52	0,34
MF-0679, LV, TBD 2884, 252 m	0,52	0,36
MF-0680, RV, TBD 2361, 241 m	0,51	0,30

Material

39 valves.

Diagnosis

A squat species of *Buntonia* with a quasi-alate VM overhang, and a truncated PM outline.

Description

External features. Rather an ungainly shape that is dominated by the inflated posteroventral part of the valve. The lateral surface rises steadily from the anterior area and the DM, producing an quasi-alate overhang along the VM. This is particularly pronounced in the RV. The AM is asymmetrically rounded, more so in the RV; the PM is quadrate and in the RV truncated. In both valves, the DM is slightly convex. The valve surface is smooth, except for three ill-defined ridges that run sub-parallel to the AM and several small depressions along the dorsal surface.

Internal features. In LV the hinge consists of a smooth quadrate PTE socket that lies at the extreme posterodorsal corner and projects above the DM. The ME is a short crenulate bar deflected at its anterior end, where it underlies a projection of the DM. ATE is a rounded socket set in an elongate depression. RV structures are conjugate but the ME

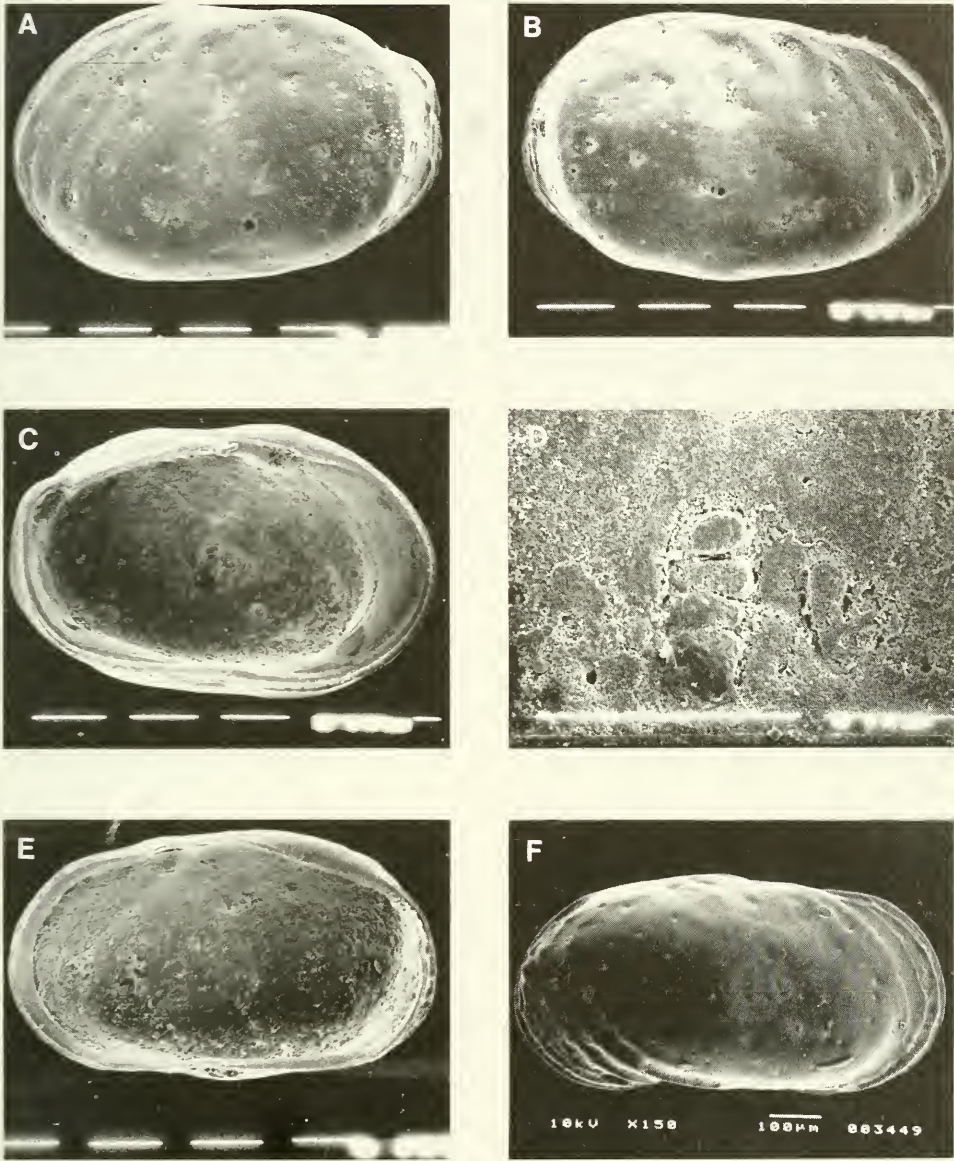


Fig. 76. A–E. *Buntonia gibbera* sp. nov. A. MF-0677, holotype, LV, TBD 2361, 241 m, SEM 2839. B. MF-0678, paratype, RV, TBD 2361, 241 m, SEM 2842. C–D. MF-0679, paratype, LV, TBD 2884, 252 m. C. Internal view, SEM 2832. D. MS, SEM 2834. E. MF-0680, paratype, RV, TBD 2361, 241 m, internal view, SEM 2835. F. *Buntonia deweti* sp. nov., MF-0759, holotype, RV, TBD 6823, 120 m, 3449. Scales: all 100 μ .

lies under an overhang of the DM, which fits above the RV ME. Anterior MA are moderately wide, and the MS consist of four rounded/ovate adductors and a fish-hook anterior scar.

Remarks

The closest relative of *Buntonia gibbera* is *Buntonia subulata rectangularis* Ruggieri, 1954, from the lower Calabrian (early Pleistocene) of Italy. The interior LV of the two species is very similar, although externally *B. gibbera* is more inflated and has a different ventral outline.

Distribution

Buntonia gibbera occurs only on the Orange Shelf between 28,4°S and 31,3°S (Fig. 75B).

Two modern valves were recovered from site TBD 2361 (241 m) at the southern limit of the species' distribution.

Relict populations occur on the middle shelf in a narrow depth range of 170–272 m.

Buntonia deweti sp. nov.

Figs 76F, 77A–F, 78A–C

Derivation of name

This species is named for Professor J. S. de Wet, former Dean of the Faculty of Science at the University of Cape Town, for his enthusiastic support of marine research off southern Africa.

Holotype

	length	height
MF-0759, RV, TBD 6823, 120 m	0,80	0,40

Paratypes

	length	height
MF-0760, LV, TBD 6823, 120 m	0,70	0,40
MF-0761, RV, TBD 6823, 120 m	0,75	0,40
MF-0762, LV, TBD 6823, 120 m	0,72	0,40

Material

Eight valves.

Diagnosis

Elongate, quadrate species of *Buntonia* with smooth valve surface, except at posterior and anterior ends, where it is reticulate and finely punctate.

Description

External features. Elongate, quadrate valve outline. AM and PM broadly rounded, the latter somewhat truncated, more prominently in RV. DM slightly convex, VM straight

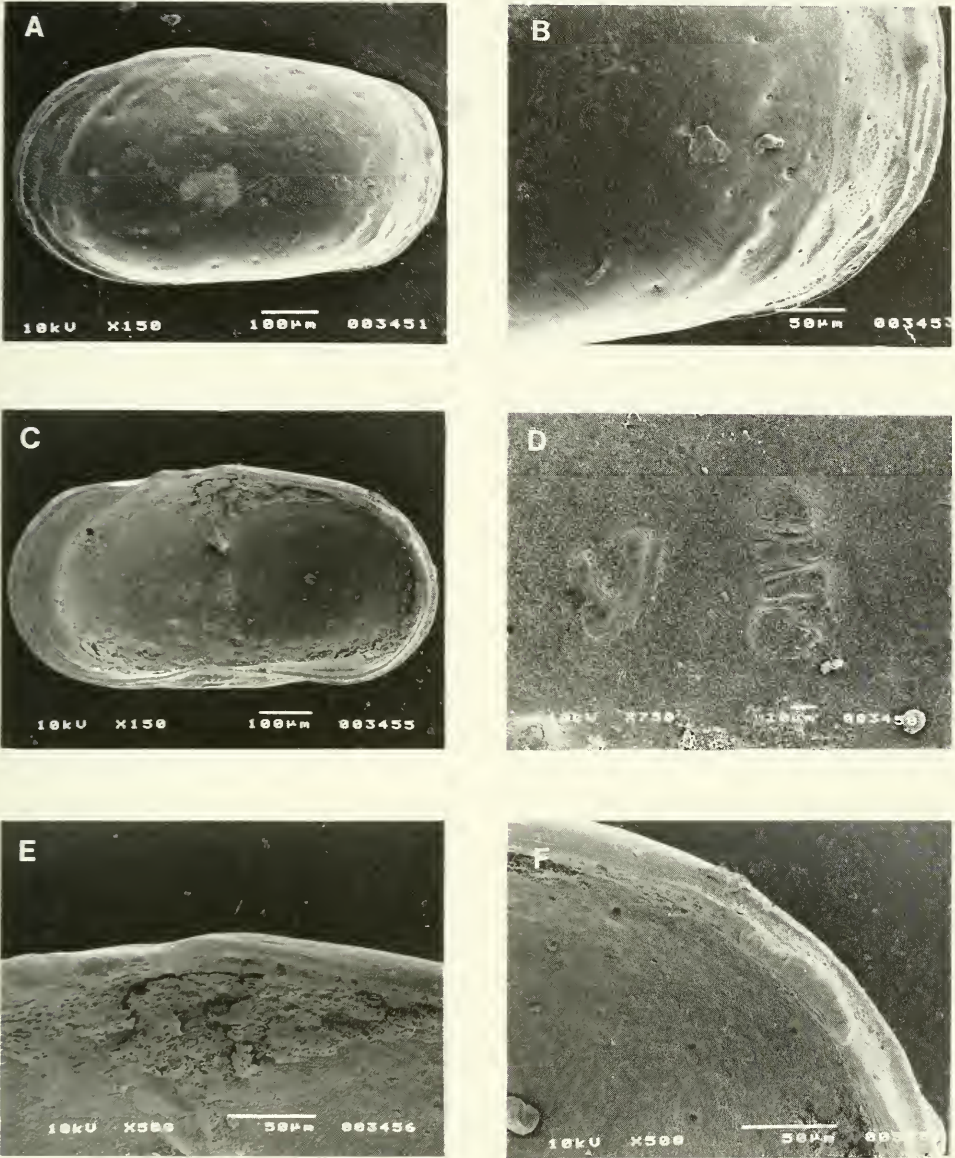


Fig. 77. A–F. *Buntonia deweti* sp. nov., paratypes, TBD 6823, 120 m. A–B. MF-0760, LV. A. SEM 3451. B. Detail of posteroventral area, SEM 3453. C–F. MF-0761, RV. C. Internal view, SEM 3455. D. MS, SEM 3458. E. ATE, SEM 3456. F. PTE, SEM 3457. Scales: A, C = 100 µ, B, E–F = 50 µ, D = 10 µ.

in LV, slightly concave in RV. Valve surface smooth except at posterior and anterior ends where there are low ribs parallel to the margins and weak reticulation. Intercostal areas are finely punctate.

Internal features. AM area moderately wide, PM area narrow. RV hinge: elongate ATE consists of a narrow double tooth, PTE is a narrow denticulate elevation. The LV ME forms a long crenulate narrow bar with denticulation at the posterior end and three small denticles at the anterior end. The LV ATE is a long wide, anteriorly opening socket. MS consist of a hook-shaped anterior scar, which has a rounded ventral extension, and four closely spaced adductors, the centre two of which are elongate, and the dorsal and ventral ones are rounded. There is a prominent, triangular fulchral point.

Remarks

Buntonia deweti has many similarities to *B. gibbera* sp. nov. in overall shape, but the former is more elongate and has a different ventral outline. *Buntonia subulata rectangularis* Ruggieri, 1954 (early Pleistocene of Italy), is also less elongate than *B. deweti*, but has similar posterior ornamentation and hinge structure. These two species differ primarily in DM outlines.

Distribution

This has the most restricted distribution of all the *Buntonia* species off south-western Africa and was recorded at only three localities to the south and west of the Cape Peninsula (Fig. 75B). Only relict specimens were recovered, having UDL and LDL of 120 m and 140 m, respectively.

Buntonia sp. 3486

Fig. 78D

Illustrated material

	length	height
MF-0773, RV, TBD 3524, 475 m	?	0,40

Material

One broken valve.

Remarks

A new species with fine-scale, star-shaped reticulation in the fossae of the primary reticulation. There is a small, narrow, V-shaped median sulcus. The most closely related local species is *Buntonia bremneri* sp. nov. The two species differ in details of ornamentation, curvature of the AM outline, and morphology of the anterodorsal area.

Distribution

This species was recovered, as a broken, modern valve, at site TBD 3524 (475 m), on the outer shelf west of Walvis Bay. It occurs well inshore of *B. bremneri* in this region (725–1 003 m).

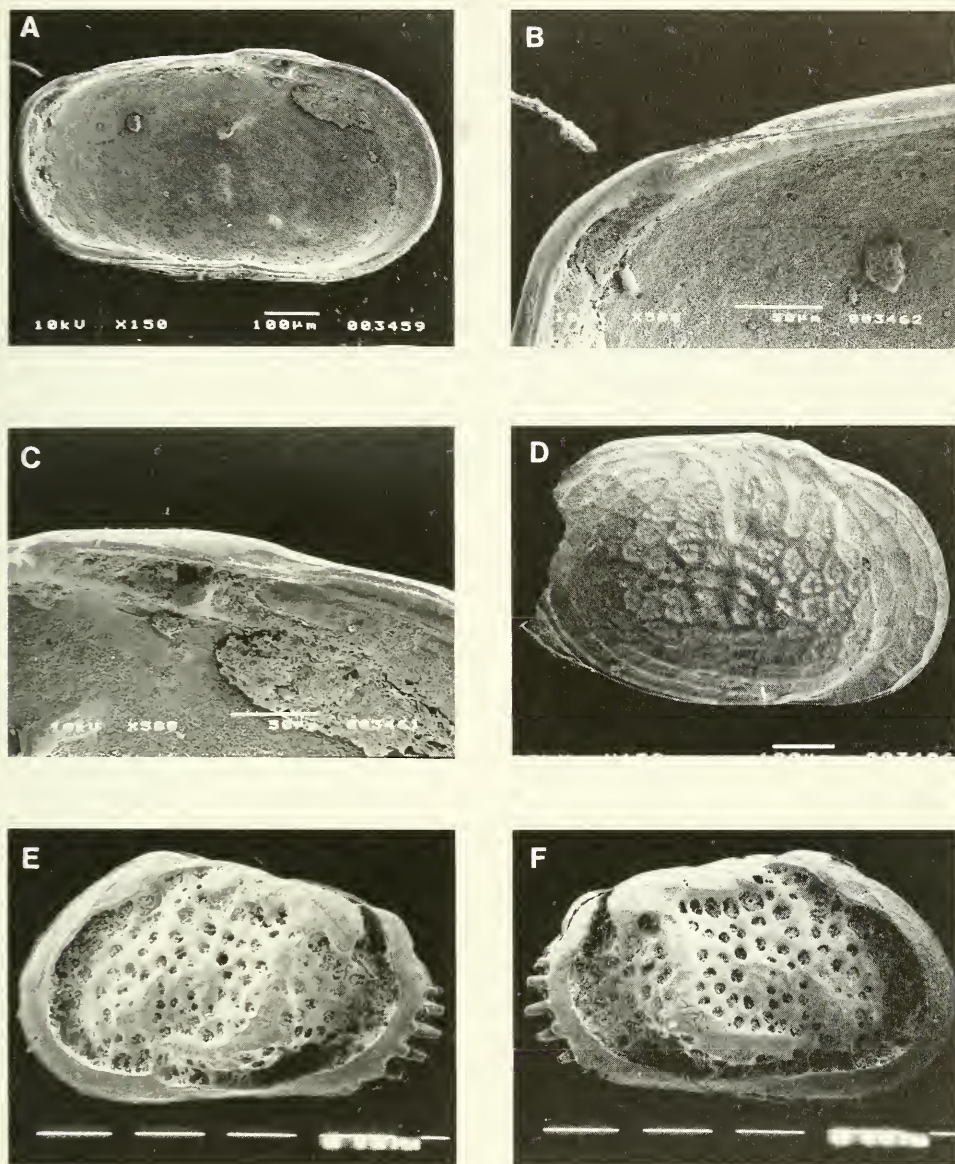


Fig. 88. A-C. *Buntonia deweti* sp. nov., MF-0762, paratype, LV, TBD 6823, 120 m. A. Internal view, SEM 3459. B. PTE, SEM 3462. C. ATE, SEM 3461. D. *Buntonia* sp. 3486, MF-0773, RV, TBD 3524, 475 m. SEM 3486. E-F. *Munseyella eggerti* sp. nov., TBD 2840, 205 m. E. MF-0681, holotype, C, left view, SEM 2763. F. MF-0682, paratype, C, right view, SEM 2766. Scales: A, D, E-F = 100 μ , B-C = 50 μ .

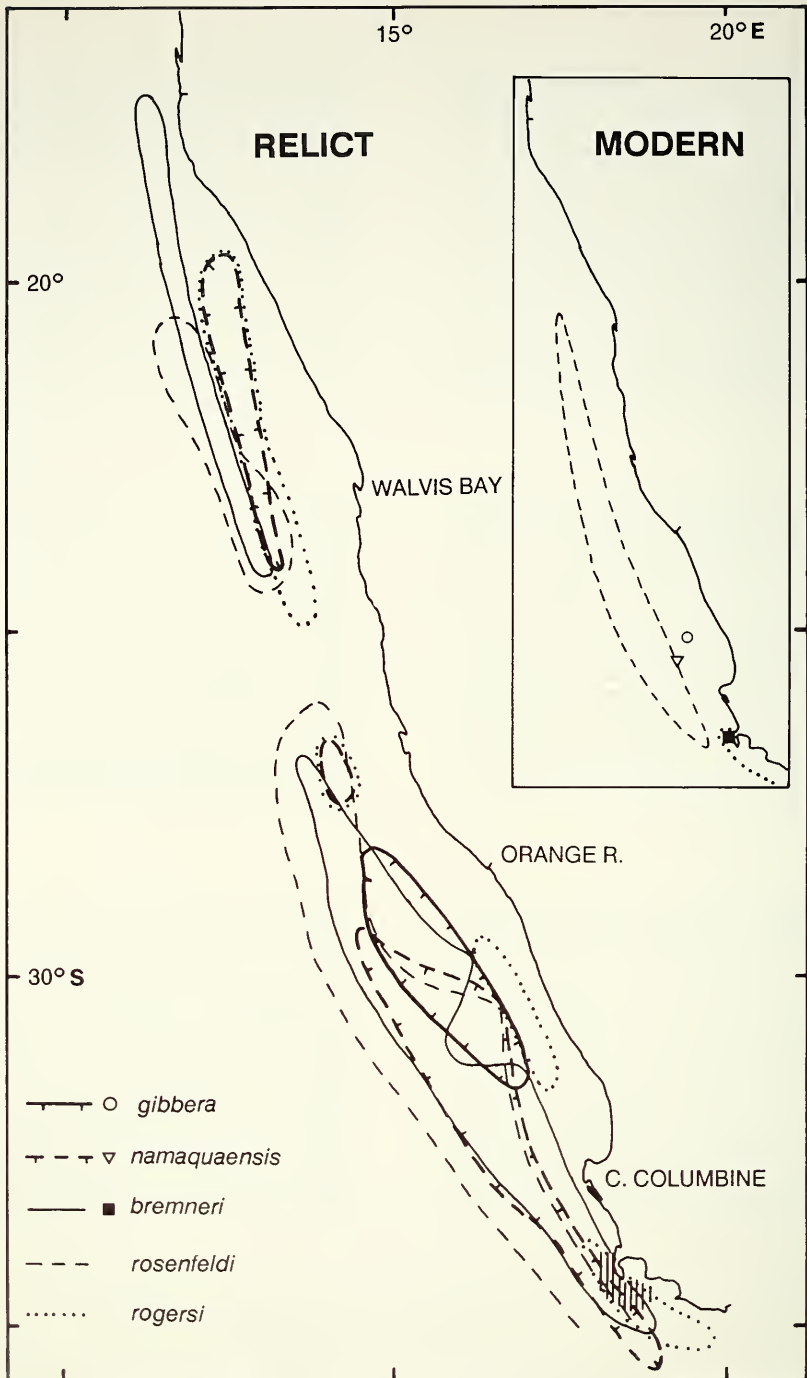


Fig. 79. Combined distributions of various species of *Buntonia* on the continental margin off south-western Africa. Shaded area off the south-western Cape is the area occupied by *B. deweti*.

Distribution of the genus Buntonia off south-western Africa

Figures 79 and 80 summarize the distribution of *Buntonia*, as well as its constituent species.

With the exception of *B. rosenfeldi*, modern populations of all species are restricted to areas south of 31°S (southern Namaqualand). Only *B. rosenfeldi* and *B. rogersi* occur relatively extensively.

In contrast, relict populations are more widely distributed, but a one degree sector north-west of Lüderitz is barren of the genus. Diversity is greatest in the area south of Lüderitz, to which *Buntonia gibbera* and *B. deweti* are restricted, and only one species, *B. bremneri*, occurs north of the Walvis Ridge abutment shelf.

The genus reaches its greatest abundance in deep water (c. 1 500 m), but at this depth only one species is present (*B. rosenfeldi*) (Fig. 80). At shallower depths, *Buntonia* is a relatively important component of the fauna at various levels on the continental shelf and upper slope above 650 m (e.g. c. 300 m, 450 m, 550 m). Below 650 m only two species of the genus occur (*B. bremneri* and *B. rosenfeldi*) and there is a progressive increase in abundance to about 1 000 m, at which depth *B. bremneri* reaches its LDL.

On the continental shelf, where six species are present, *B. rogersi*, *B. bremneri* and,

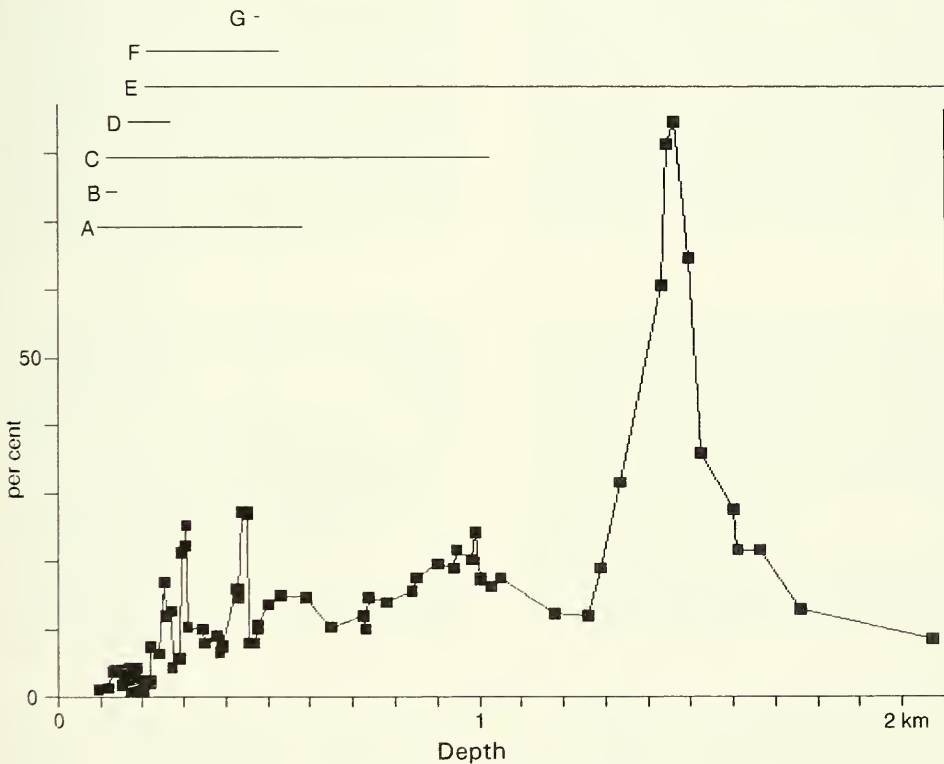


Fig. 80. Depth ranges (bars) of various species of *Buntonia* that occur in water depths < 950 m. Graph shows the percentage of the total ostracod fauna for the combined species of *Buntonia*. A = *B. rogersi*, B = *B. deweti*, C = *B. bremneri*, D = *B. gibbera*, E = *B. rosenfeldi*, F = *B. namaquaensis*, G = *Buntonia* sp. 3486.

to a lesser extent, *B. namaquaensis* are the most abundant taxa, with the former having the shallowest UDL.

Family **Pectocytheridae** Hanai, 1957

Genus *Munseyella* van den Bold, 1957

This genus occurs widely in North America, the Far East, and Australasia. From the southern South Atlantic records are more sparse but five species have been noted from Upper Cretaceous to Pleistocene sediments of South America. By contrast, only one possible species has previously been noted from southern Africa, with none reported in the inventories of the Cretaceous and Tertiary of western Africa.

Munseyella eggerti sp. nov.

Figs 78E-F, 81A-D

Occultocythereis sp. 1 Boomer, 1985: 30-31, pl. 2 (fig. 32).

Derivation of name

This species is named for Captain Walter Eggert, master of the University of Cape Town research vessel, 'Thomas B. Davie', during most of the west-coast sediment sampling cruises.

Holotype

	length	height
MF-0681, C, TBD 2840, 205 m	0,58	0,35

Paratypes

	length	height	width
MF-0682, C, TBD 2840, 205 m	0,58	0,35	
MF-0683, LV, TBD 2472, 201 m	0,60	0,33	
MF-0684, RV, TBD 2840, 205 m	0,54	0,31	
MF-0685, C, TBD 2840, 205 m	0,58		0,25

Material

32 valves.

Diagnosis

A species of *Munseyella* with prominent PM spines and a massive posterodorsal process.

Description

External features. Small, squat valves, with a latitudinally compressed carapace. AM broadly and asymmetrically rounded, PM somewhat angular and truncated. DM and VM almost straight, converging slightly posteriorly. Broad, flattened AM and PM rims are continuous via a slender connecting rib along the VM. Immediately posterior to the AM and PM rims, the valve surface is strongly compressed. PM bears five stout spines. DM has a thick, flattened nodose rim widening to a massive flattened posterodorsal process.

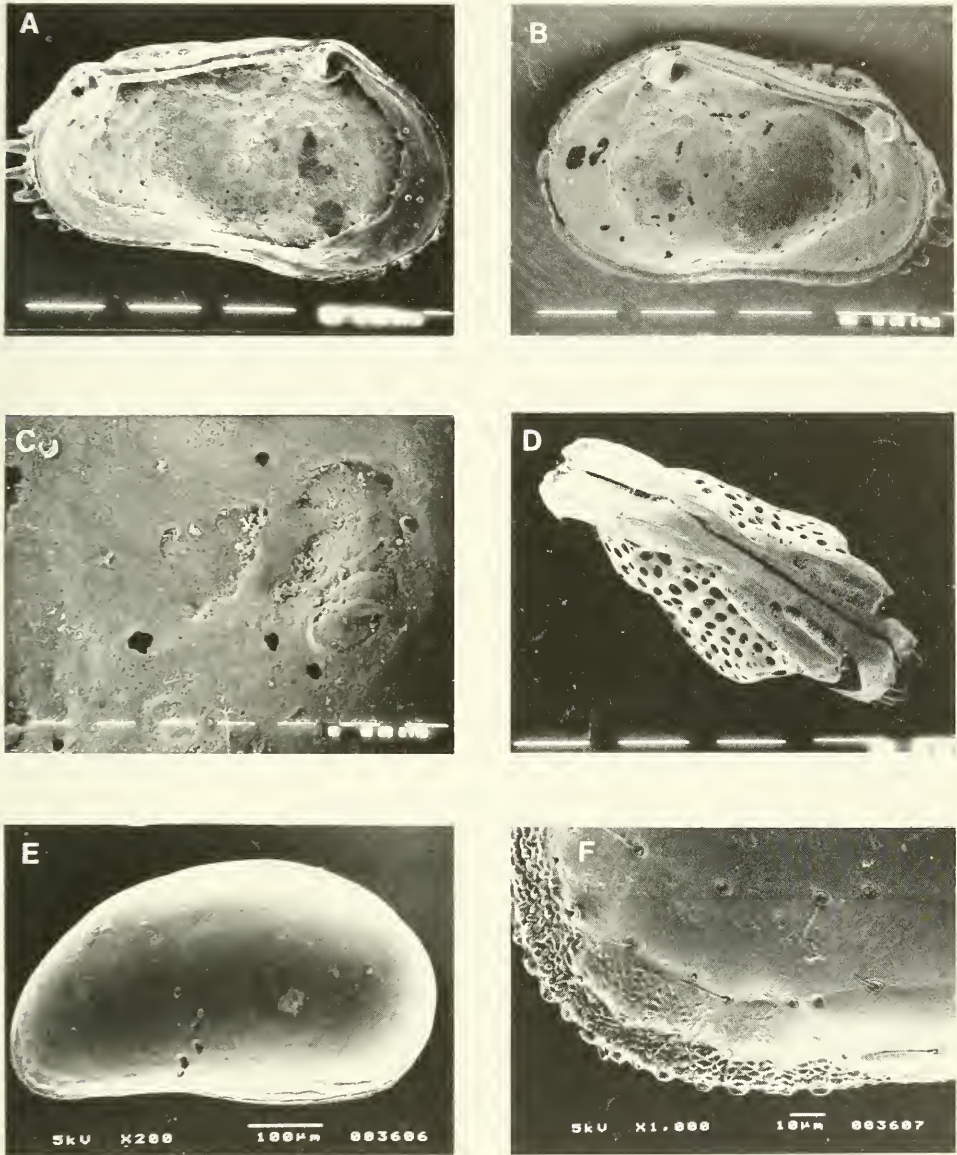


Fig. 81. A-D. *Munseyella eggerti* sp. nov., paratypes. A. MF-0683, LV, TBD 2472, 201 m, internal view, SEM 2774. B-C. MF-0684, RV. B. Internal view, SEM 2768. C. MS, SEM 2770. D. MF-0685, C, TBD 2840, 205 m, dorsal view, SEM 2772. E-F. *Xestoleberis capensis* Müller, 1908, MF-0795, LV, TBD 6824, 90 m. E. SEM 3606. F. Detail of anteroventral area, SEM 3607. Scales: A-B, D-E = 100 μ , C, F = 10 μ .

It is connected by a thick, vertical ridge that curves anteriorly at its ventral end, at which point the valve surface is inflated, and thence runs to about one-third valve length parallel to the VM. There is an ill-defined swelling in the region of the sub-central process. Overall, the valve surface is coarsely reticulate, with a secondary micro-punctuation.

Internal features. Anterior and posterior MA relatively wide. Hinge amphidont. In RV the TE are large, with the PTE sub-divided. ME is relatively narrow, with prominent peg-like teeth at both ends (the 'pentodont' hinge illustrated in Van Morkhoven (1963: 116)). MS consist of a large V-shaped anterior scar and four relatively smaller adductors.

Remarks

Munseyella eggerti is typical of the genus in general outline and hinge structure but no other species appears to be especially close to it. The species recorded by Dingle (1976) as Gen. indet. 5 sp. 1 (middle Eocene, Jc-1 borehole offshore Natal) is similar, but lacks the coarseness in ribbing and deep indentation on the posterior side of the AM rim.

Distribution

This species occurs only on the Orange Shelf between latitudes 28,4°S and 30,9°S (Fig. 82). Four further specimens have been found slightly farther north (27,9°S) in a reworked Tertiary assemblage (TBD 3004).

Modern valves occur only at site (TBD 2840: 205 m), whereas the relict population lies along the outer part of the Orange Shelf in a narrow depth range between 186 m and 252 m.

Family Xestoleberidae Sars, 1928

Genus *Xestoleberis* Sars, 1928

Xestoleberis capensis Müller, 1908

Fig. 81E-F

Xestoleberis capensis Müller, 1908: 127-128; 1912: 300. Stebbing, 1910: 505. Benson & Maddocks, 1964: 26-27, pl. 2 (fig. 12), text-fig. 15.

Xestoleberis ramosa Müller. Hartman, 1974 (*part.*—Knysna specimens only).

Illustrated material

	length	height
MF-0795, LV, TBD 6824, 90 m	0,55	0,32

Material

22 valves.

Remarks

Hartmann (1974) considered Benson & Maddocks's (1964) identification of this species to be in error, and the material they recorded from Leisure Island in Knysna Lagoon to be *X. ramosa* Müller, 1908. However, the reasons advanced by Benson &

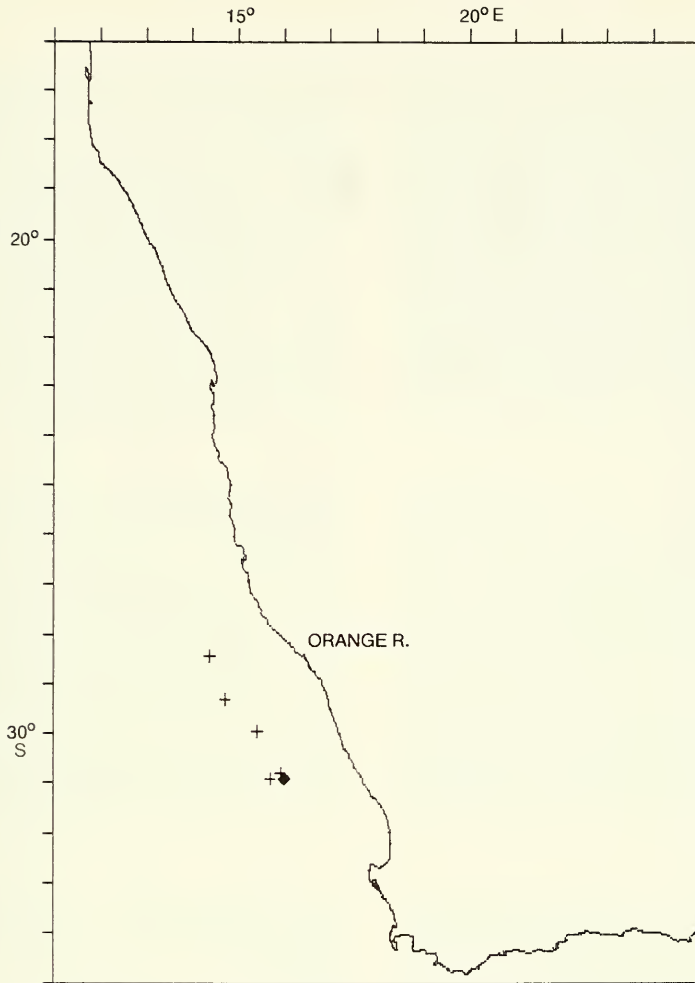


Fig. 82. Distribution of *Munseyella eggerti* sp. nov. on the continental margin off south-western Africa. Black diamond = modern occurrence.

Maddocks (1964) appear sound, and my specimens are conspecific with material in the South African Museum collections from their study.

The relative straightness of the VM (compared to the sinuous outline of *X. ramosa*), as well as the more elongate outline of the valve in lateral view and the more acutely rounded AM, are well displayed by my specimens.

Distribution

Müller (1908) recovered *X. capensis* from False Bay (Simonstown Harbour), and Benson & Maddocks (1964) recorded the species from Knysna Lagoon. In the present study, this species was recorded at two sites west of the Cape Peninsula.

A modern valve was recovered at TBD 6821 (15 m) in Hout Bay, whereas relict specimens occur at both TBD 6821 and 6824 (90 m).

Xestoleberis ramosa Müller, 1908

Fig. 83A

Xestoleberis ramosa Müller, 1908: 128–130, text-figs 1–8. Klie, 1940: 428–429. Hartmann, 1974: 324 (part.—non Knysna specimens).

Illustrated material

	length	height
MF-0794, LV, TBD 6821, 15 m	0,54	0,33

Material

Three valves.

Remarks

Following the original descriptions of Müller (1908), *X. ramosa* and *X. capensis* Müller are distinguished by the former's more angular DM and PM, and less elongate AM outline.

Distribution

Previous accounts (Müller 1908; Klie 1940) record *X. ramosa* from coastal sites at Lüderitz and False Bay (Simonstown Harbour). I encountered this species at site TBD 6821 (15 m) in Hout Bay, where three modern valves were recovered. These records suggest that *X. ramosa* is exclusively an inshore taxon.

Xestoleberis sp. 3398

Fig. 83B

Illustrated material

	length	height
MF-0729, LV, TBD 5254, 40 m	0,44	0,23

Material

Thirteen valves.

Remarks

This small elliptical species is probably new.

Distribution

All the specimens available are probably modern. This species has been recovered from three localities around the Cape Peninsula, where its depth range is 40–90 m.

Xestoleberis sp. 3524

Fig. 83C

Illustrated material

	length	height
MF-0743, RV, TBD 6824, 90 m	0,54	0,31

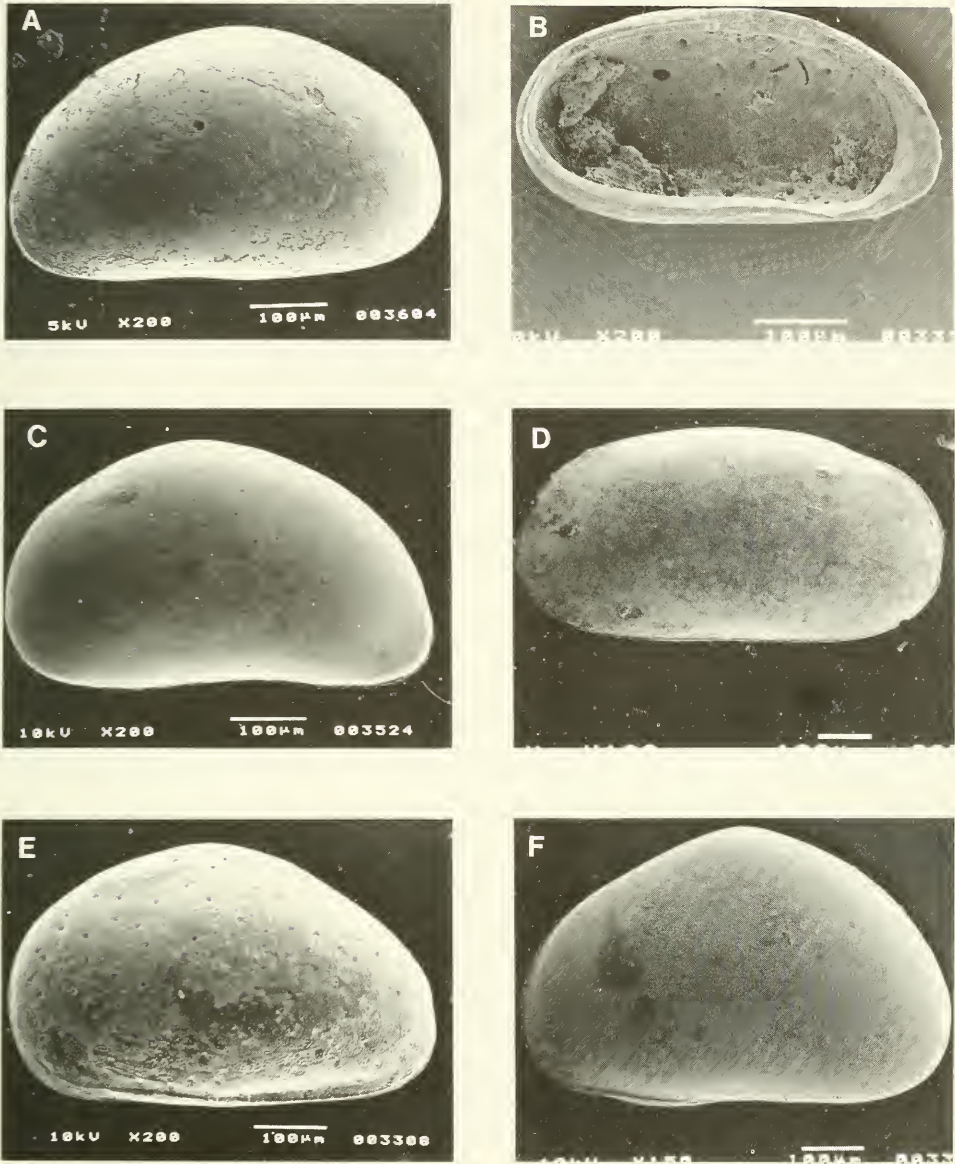


Fig. 83. A. *Xestoleberis ramosa* Müller, 1908, MF-0794, LV, TBD 6821, 15 m, SEM 3604. B. *Xestoleberis* sp. 3398, MF-0729, LV, TBD 5254, 40 m, internal view, SEM 3398. C. *Xestoleberis* sp. 3524, MF-0743, RV, TBD 6824, 90 m, SEM 3524. D-F. Indeterminate species. D. Indet. sp. 3306, MF-0708, RV, TBD 4656, 15 m, SEM 3306. E. Indet. sp. 3308, MF-0709, LV, TBD 6821, 15 m, SEM 3308. F. Indet. sp. 3343, MF-0742, LV, TBD 6824, 90 m, SEM 3343. Scales: all 100 μ .

Material

One valve.

Remarks

A single modern valve of a species of similar outline to *X. ferax* Klie, 1940. The hinge of *Xestoleberis* sp. 3524 is relatively weak, and the '*Xestoleberis*' spot was not clearly seen.

Distribution

This species was recovered from site TBD 6824 (90 m) west of the Cape Peninsula. *Xestoleberis ferax* was found at coastal sites at Lüderitz and Kommetjie (Cape Peninsula) by Klie (1940) and Hartmann (1964).

Indeterminate species

Indet. sp. 3306

Fig. 83D

Illustrated material

	length	height
MF-0708, RV, TBD 4656, 15 m	0,72	0,35

Material

One valve.

Remarks

A fragile, smooth, laterally compressed species with an adont hinge and four adductor MS (anterior scars not visible).

Distribution

This species was recovered modern from site TBD 4656 (15 m) inshore in the vicinity of the Orange River mouth. It was the only ostracod valve in the sample.

Indet. sp. 3308

Fig. 83E

Illustrated material

	length	height
MF-0709, LV, TBD 6821, 15 m	0,57	0,35

Material

One valve.

Remarks

A modern (?juvenile) valve of an ovate species ornamented with very fine puncta

arranged in lines separated by low, narrow ribs. The species has a hemimerodont hinge, narrow inner lamella, and numerous prominent normal pores.

Distribution

This species was recovered from site TBD 6821 (15 m) in Hout Bay.

Indet. sp. 3343

Figs 83F, 84A

Illustrated material

	length	height
MF-0742, LV, TBD 6824, 90 m	0,65	0,40

Material

One valve.

Remarks

This modern valve is of a species with a strongly convex DM. The surface is ornamented overall with very fine punctae. There are numerous small normal pores. It has wide AM vestibules but the nature of the MPC could not be discerned. I suspect that this is a juvenile valve of a non-marine species that has been transported from the nearby Cape Peninsula.

Indet. sp. 3412

Fig. 84B

Illustrated material

	length	height
MF-0732, RV, TBD 3320, 72 m	0,47	0,26

Material

One valve.

Remarks

Probably an immature specimen of an elongate and weakly reticulate species.

Distribution

This species was recovered relict at site TBD 3320 (72 m) from the inner Namaqualand shelf.

Indet. sp. 3426

Fig. 84C-D

Illustrated material

	length	height
MF-0735, C, TBD 6836, 80 m	0,48	0,39

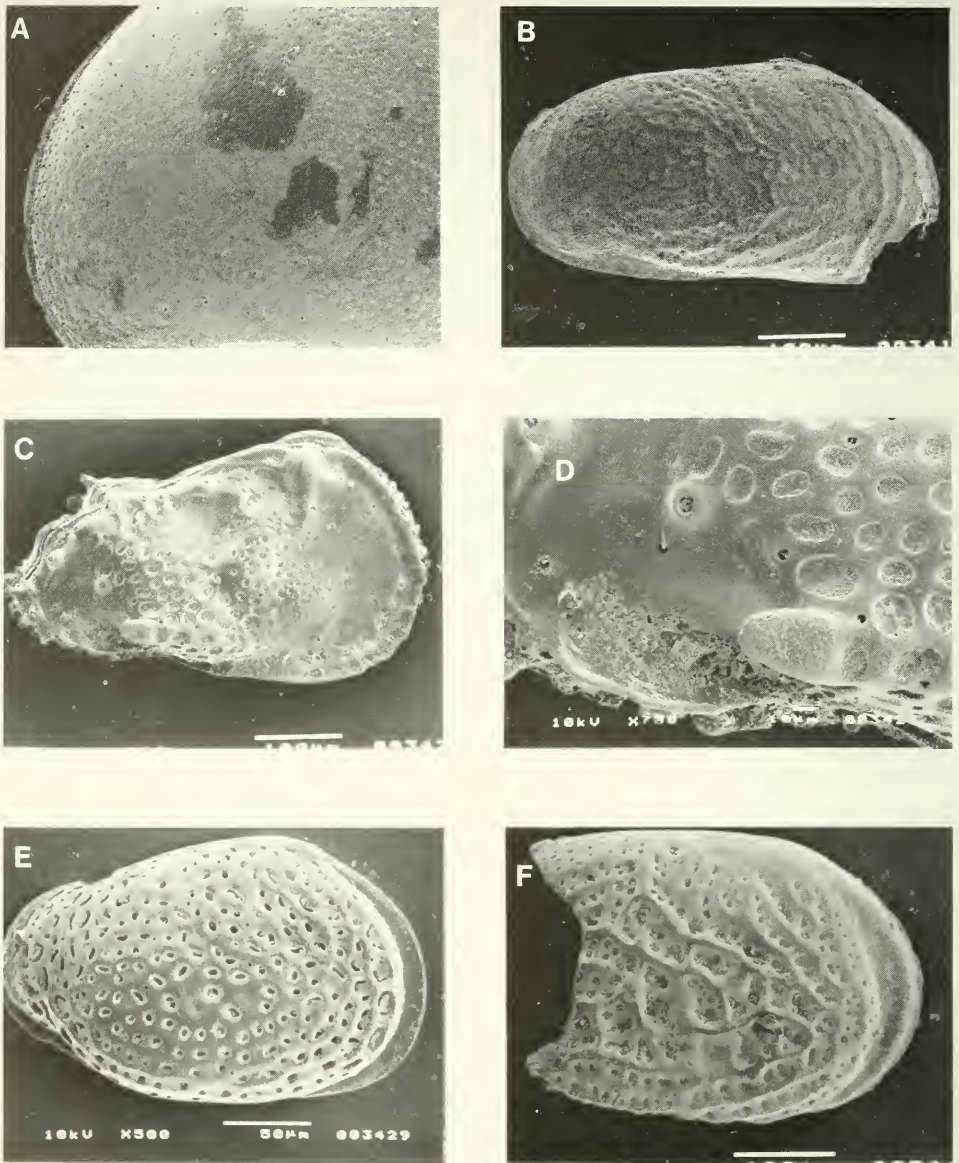


Fig. 84. A-F. Indeterminate species. A. Indet. sp. 3343, MF-0742, LV, TBD 6824, 90 m, SEM 3436. B. Indet. sp. 3412, MF-0732, RV, TBD 3320, 72 m, SEM 3412. C-D. Indet. sp. 3426, MF-0735, C, TBD 6836, 80 m. C. SEM 3426. D. Detail of posteroventral area, SEM 3427. E. Indet. sp. 3429, MF-0737, RV, TBD 344, 73 m, SEM 3429. F. Indet. sp. 3447, MF-0758, RV, TBD 3928, 117 m, SEM 3447. Scales: A, E = 50 μ . B-C, F = 100 μ . D = 10 μ .

Material

Eight valves.

Remarks

All the available material is juvenile and none shows clear MS impressions. The species is probably a trachyleberid, and has a distinctive pair of flattened spines at the posterodorsal and posteroventral corners. There is a prominent eye and SCT, and the AM margin is very broadly rounded.

Distribution

This species was recovered from three sites south and west of the Cape Peninsula (depth range 73–90 m). All the specimens are modern. Unpublished data record it in intertidal rock pools in the vicinity of Cape Town.

Indet. sp. 3429

Fig. 84E

Illustrated material

	length	height
MF-0737, RV, TBD 344, 73 m	0,24	0,15

Material

One valve.

Remarks

A very small (240 μ) rotund reticulate species. It is probably a juvenile.

Distribution

This species was recovered from site TBD 344 (73 m) on the inner shelf west of Cape Agulhas.

Indet. sp. 3447

Fig. 84F

Illustrated material

	length	height
MF-0758, RV, TBD 3928, 117 m	?	0,27

Material

One fragment.

Remarks

A modern specimen of a strongly ornamented species with a hemimerodont hinge.

Distribution

This species was recovered from site TBD 3928 (117 m) from the Walvis Ridge Abutment shelf.

Indet. sp. 3481

Fig. 85A

Illustrated material

	length	height
MF-0770, RV, TBD 2860, 170 m	0,75	0,40

Material

One valve.

Remarks

A stoutly spinose species with a large, domed eye tubercle.

Distribution

This species was recovered from site TBD 2860 (170 m) on the mid-Orange Shelf.

Indet. sp. 3539

Fig. 85B

Illustrated material

	length	height
MF-0749, LV, TBD 6824, 90 m	0,63	0,32

Material

One valve.

Remarks

A juvenile specimen with a wide anterior inner lamella and vestibule.

Distribution

This species was recovered from site TBD 6824 (90 m) west of the Cape Peninsula.

Indet. sp. 3543

Fig. 85C

Illustrated material

	length	height
MF-0751, C. TBD 6847, 94 m	0,33	0,21

Material

Two valves.

Remarks

A small rotund, smooth species with a prominent posteroventral swelling and angular PM outline.

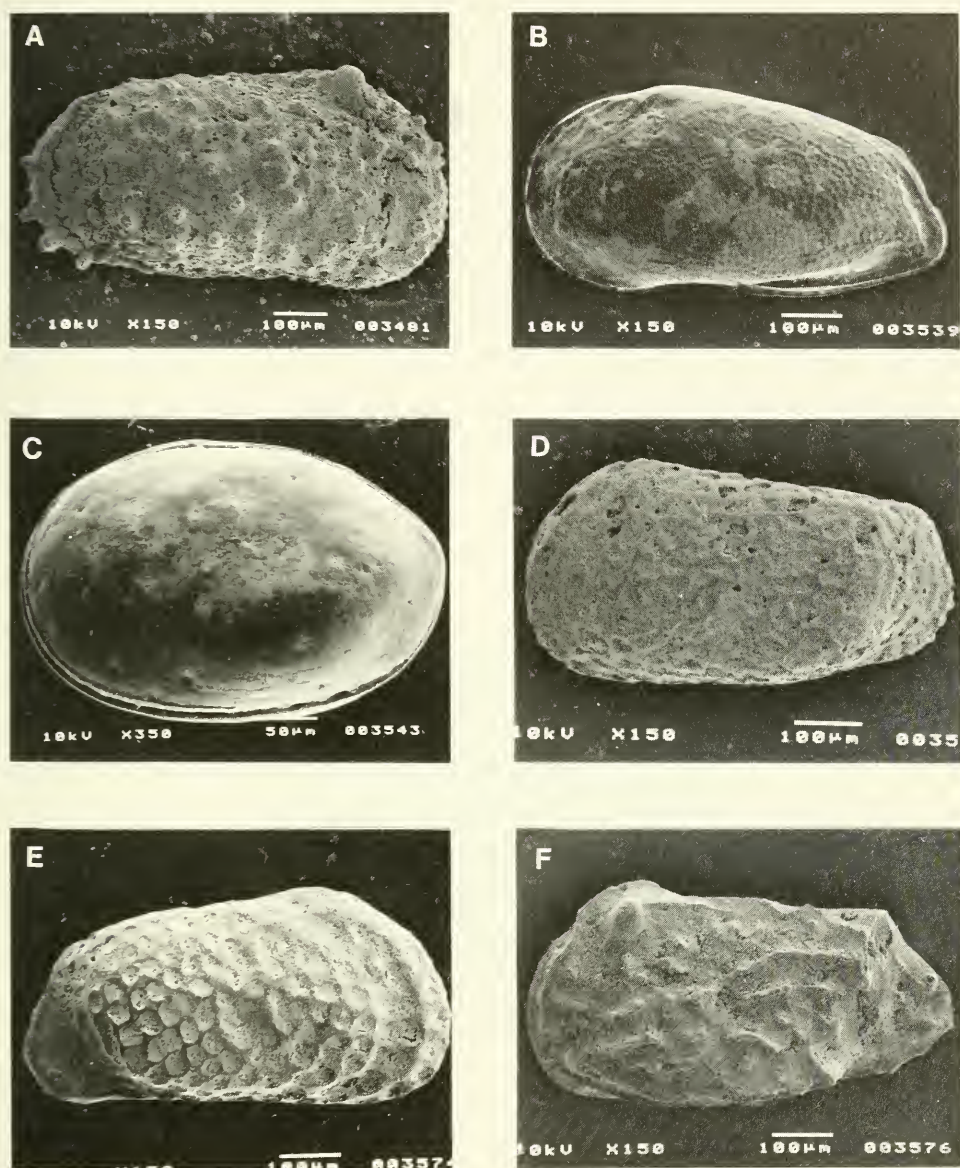


Fig. 85. A-F. Indeterminate species. A. Indet. sp. 3481, MF-0770, RV, TBD 2860, 170 m, SEM 3481. B. Indet. sp. 3539, MF-0749, LV, TBD 6824, 90 m, SEM 3539. C. Indet. sp. 3543, MF-0751, C, TBD 6847, 94 m, left view, SEM 3543. D. Indet. sp. 3565, MF-0783, LV, TBD 2717, 218 m, SEM 3565. E. Indet. sp. 3574, MF-0787, RV, TBD 2719, 240 m, SEM 3574. F. Indet. sp. 3576, MF-0788, LV, TBD 2719, 240 m, SEM 3576. Scales: A-B, D-F = 100 μ , C = 50 μ .

Distribution

This species was recovered modern from site TBD 6847 (94 m) west of the Cape Peninsula.

Indet. sp 3565

Fig. 85D

Illustrated material

	length	height
MF-0783, LV, TBD 2717, 218 m	0,60	0,32

Material

Two valves.

Remarks

Probably immature specimens of a coarsely reticulate species.

Distribution

This species was recovered relict from site TBD 2717 (218 m) on the outer Orange-Namaqualand shelf.

Indet. sp. 3574

Fig. 85E

Illustrated material

	length	height
MF-0787, RV, TBD 2719, 240 m	0,67	0,34

Material

One valve.

Remarks

Probably an immature specimen of a coarsely reticulate species. The posteroventral margin is drawn out and deflected ventrally.

Distribution

This species was recovered relict from site TBD 2719 (240 m) on the outer Orange-Namaqualand shelf.

Indet. sp. 3576

Fig. 85F

Illustrated material

	length	height
MF-0788, LV, TBD 2719, 240 m	0,64	0,35

Material

One valve.

Remarks

Surface ornamentation is reminiscent of *Ambostracon* (*A.*) sp. 3571.

Distribution

I suspect that this valve is reworked from older strata. The species was recorded from site TBD 2719 (240 m) on the Orange Shelf.

Indet. sp. 3578

Fig. 86

Illustrated material

	length	height
MF-0789, RV, TBD 2361, 241 m	0,59	0,33

Material

One valve.



Fig. 86. Indet. sp. 3578, MF-0789, RV, TBD 2361, 241 m, SEM 3578. Scale: 100 μ .

Remarks

Probably a modern juvenile of a species with strongly compressed AM areas, and a short curved dorsolateral rib.

Distribution

This species was recovered from site TBD 2361 (241 m) on the outer Orange-Namaqualand shelf.

SUMMARY

A total of 104 species in at least 42 genera constitute the minor ostracod taxa on the continental margin off south-western Africa (the arbitrary definition for a minor species was taken as <2 % of the total assemblage available). In total, these comprise 13 per cent by abundance of the fauna studied.

Twenty-three species have an abundance of >1 per cent within the minor taxa, and of these *Bairdoppilata simplex* (15,0%) and *Chrysocythere craticula* (12,3%) dominate (Table 4). The most diverse genera are: *Cytheropteron* (10 species); *Buntonia* (7 species); *Semicytherura* (5 species); and *Urocythereis* (5 species).

The distribution of the ostracod assemblages as a whole will be dealt with in Part III of this report (Dingle in prep.), but it is opportune to present some general remarks on the minor taxa. These are based on samples that contain at least ten valves.

TABLE 4
Minor taxa: the most abundant species.

Species	No. of specimens	Percentage minor taxa	Percentage total fauna
<i>Bairdoppilata simplex</i>	435	15,0	1,8
<i>Chrysocythere craticula</i>	358	12,3	1,5
<i>Urocythereis arcana</i>	166	5,7	0,7
<i>Krithe capensis</i>	143	4,9	0,6
<i>Neocaudites osseus</i>	142	4,9	0,6
<i>Poseidonamicus panopsus</i>	119	4,1	0,5
<i>Cytheropteron whatleyi</i>	109	3,7	0,4
<i>Macrocypris</i> cf. <i>M. nietuenda</i>	102	3,5	0,4
<i>Australoecia fulleri</i>	96	3,3	0,4
<i>Incongruella venusta</i>	93	3,2	0,4
<i>Austroaurila rugosa</i>	90	3,1	0,3
<i>Coquimba birchi</i>	86	2,9	0,3
<i>Buntonia brenneri</i>	78	2,7	0,3
<i>Cytheropteron trinodosum</i>	75	2,5	0,3
<i>Parakrithella simpsoni</i>	68	2,3	0,2
<i>Propontocypris</i> cf. <i>P. (P.) subreniformis</i>	66	2,2	0,2
<i>Buntonia rosenfeldi</i>	46	1,6	0,2
<i>Buntonia rogersi</i>	45	1,5	0,2
<i>Aurila kliei</i>	43	1,5	0,1
<i>Buntonia gibbera</i>	39	1,3	0,1
<i>Buntonia namaquaensis</i>	36	1,2	0,1
<i>Kangarina mucronata</i>	36	1,2	0,1
<i>Munseyella eggerti</i>	35	1,2	0,1

Variations with water depth

The number of species present in each sample generally declines in an offshore direction in a transect across the continental margin, but the gradient of the smoothed curve varies considerably (Fig. 87A). The distribution is subdivided by a zone of low values straddling 300 m water depth. Inshore of 300 m, the mean value is 10 species per sample, but diversity declines rapidly seaward from individual highs of 20 species per sample in water depths <200 m. Beyond the 300 m low, values rise to a peak at 500 m, before falling gradually across the upper slope. Mean values on the outer shelf and upper slope are six species per sample.

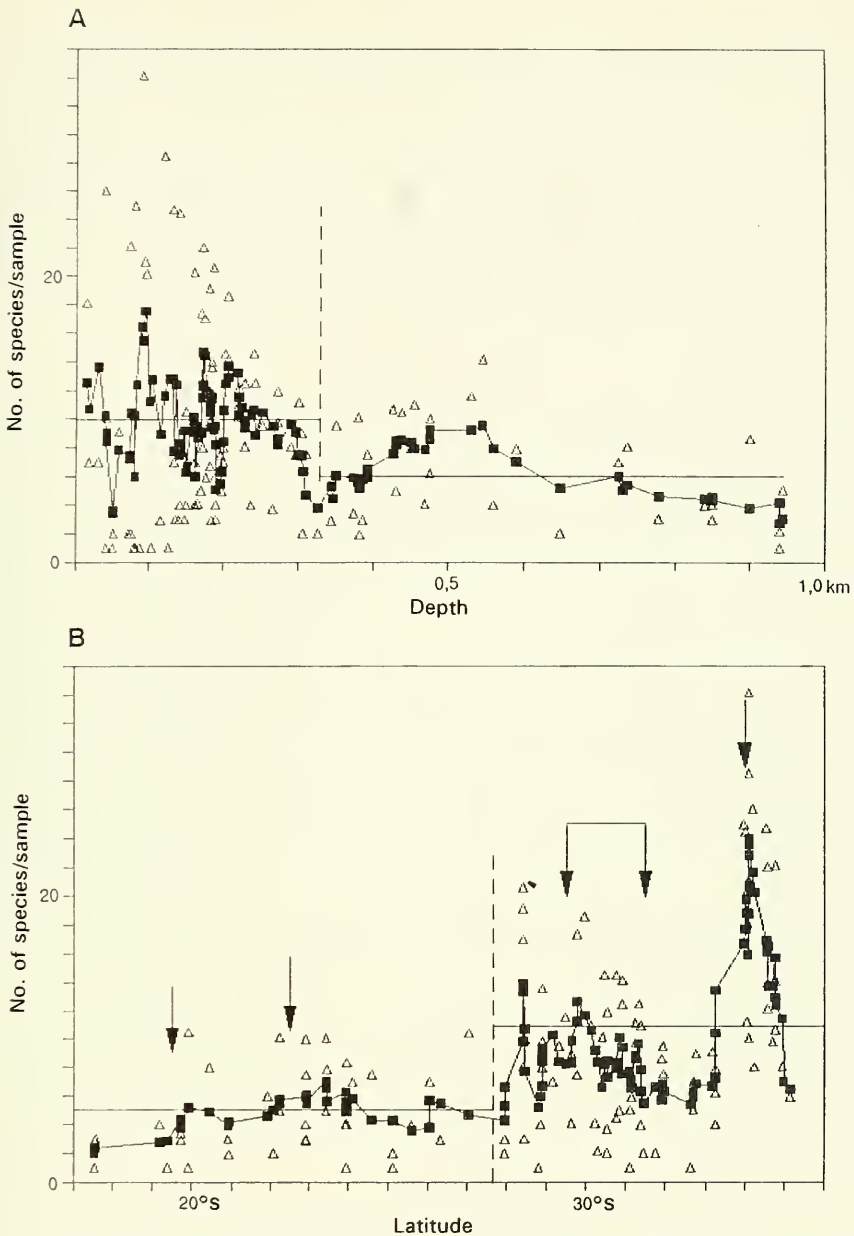


Fig. 87. A. Number of minor species/sample (Y-axis) plotted against water depth. Raw data points are open triangles, smoothed curve (squares) is a five-point running mean. Horizontal lines are mean values for samples either side of the dashed vertical line: < 320 m, mean = 9,9; > 320 m, mean = 6,1. B. Number of minor species/sample (Y-axis) plotted against latitude. Raw data points are open triangles, smoothed curve (squares) is a five-point running mean. Horizontal lines are mean values for samples either side of the dashed vertical line: 17°–27,7°S, mean = 4,9; 27,7°–35°S, mean = 10,7. Vertical arrows indicate high incidences of latitudinal range limits at: 19,5°S (Walvis Ridge abutment); 22,5°S (Walvis Bay); 29,5°–31,5°S (Namaqualand shelf); and 34°S (Cape Peninsula). In both data sets, only samples with 10 or more specimens were included.

The region shallower than 300 m is populated predominantly by endemic species (75 species are confined to this zone), compared to deeper water, to which only nine are confined. The relatively large numbers of species of the minor taxa that have their lower depth limits between 200 m and 300 m (19 species) suggests that the boundary of the mixed layer and the Antarctic Intermediate Water (AAIW) is a major barrier to downslope migration (see Dingle & Lord 1990). A further high value in incidence of LDL occurs between 500 m and 600 m water depth (8 species), which is reflected in Figure 87A by the sharp decline in the mean value of species per sample at 550–650 m, and coincides with the upper part of the salinity minimum zone of the AAIW, a further barrier to downslope migration (see Dingle *et al.* 1989).

Variations with latitude

The number of species in each sample generally increases from north to south along the continental margin between 17°S and 35°S, but the smoothed curve has several gradient changes that correlate with other parameters, in particular alterations in the number of extant species and latitudinal range limits (Fig. 87B). The latter signify boundaries between along-shelf faunal assemblages.

A wide zone of low values for number of species per sample occurs between approximately 25,5°S and 27,5°S (centred on Lüderitz), and subdivides the whole region—to the north the mean value is five species per sample, and to the south 11 species per sample. Peaks on the curve in the northern sector occur at 20°S (Walvis Ridge abutment) and 23°S (Walvis Bay), and lie immediately south of concentrations of latitudinal range limits (shown by arrows in Fig. 87B). These have been determined using the total latitudinal range of each species, and the most significant concentration is the northern range limit (NRL) of ten species on the Walvis Ridge.

Immediately south of the Lüderitz species hiatus, there is a wide zone on the Orange–Namaqualand shelf (27,5°S–31,5°S) of fluctuating and generally high values of species numbers. This area of the shelf contains many endemic species, as well as coinciding with the southern (4 species/sample) and northern (7 species/sample) latitudinal range limits of several species.

A narrow sector of the shelf adjacent to Cape Columbine–Saldanha Bay (33°S) has a low abundance of species per sample, but immediately to the south, off the Cape Peninsula and the south-western Cape, values are highest for the whole margin, and also coincide with major incidences of NRL (76 species/sample) and SRL (48 species/sample). Clearly, this sector is a first order boundary between west-coast and south-coast faunas, and may contain a high proportion of endemic taxa.

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